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## Sub-station, Distribution and Office Methods of the Chicago Edison Company.

The completion of the great central generating plant of the Chicago Edison company at Harrison street, on the west side of the river, made necessary the conversion of the old central station at Adams street into a sub-station for distribution and an office building for the executive and commercial headquarters of the company. The machinery in the new central station was formally put in operation in August, 1894, and thereafter the down-town load was gradually transferred from the old plant in Adams street to the improved modern equipment at Harrison street, with its massive direct-connected machinery, which, as a whole, is considered to represent the latest advance in central station economy. The Adams street building was then completely remodeled. Up to that time it had been the principal source of constant-potential electricity in Chicago. With all generating machinery taken out, the change has made it a very attractively arranged aggregation of offices for the transaction of the business of a great central station company, a depot for electrical supplies and the distributing center for a system of feeders extending to the various junction boxes in the network of underground mains in the down-town business district of the city. The electrical energy now comes into the building through an immense trunk line feeder from the Harrison street station. This transformation marks a very interesting phase of central station development in Chicago. It is the purpose of the present article to give the readers of the WESTERN ELECTRICIAN a succinct description of the manner of distributing current from this building and the general routine of business within it.

RETROSPECTIVE.

It is a significant commentary on the rapid growth of the electrical business that the Adams street central station, now entirely superseded, was completed as late as August 8, 1888, being in service for a period of less than seven years. At the date of its erection, however, it was considered a fine example of electrical and mechanical engineering in central lighting and power station work. The boilers and engines were located on the first floor, with dynamos on the second floor. The boilers were of the Heine water-tube pattern, supplying steam to high-speed Armington & Sims and McIntosh & Seymour engines, each engine driving by belting a pair of Edison bipolar dynamos. The switchboards were built of Georgia pine, all conductors being of polished copper erected in a substantial manner. Each feeder was provided with equalizers and amperemeters, with an elaborate system of potential indicators for showing the relative condition of electrical pressure at the ends of the feeders in the street system. The offices and salesroom of the company occupied a small space in the front of the building in the first and second stories, with the meter department on the third floor front. The station started in operation with four engines and eight dynamos, a total capacity of 800 horse power, additions being made from time to time; and at the time the plant was abandoned as a generating station there were nine boilers, 14 engines and 28 dynamos, with a total capacity of 4,500 horse power.

The growth of the business of the company was phenomenal and quite exceeded the most sanguine hopes of its promoters. With the demand for increased space for machinery the offices were gradually moved to the Rookery Building opposite, and there they remained during the building of the Harrison street station, and until the 1st of May, 1895, when, after three months of hard work the Adams street station was cleared of its machinery and transformed into what is pronounced by many prominent central station managers to be the best arranged and most complete office building for central station business in the country.

FIG. 1. SUB-STATION, DISTRIBUTION AND OFFICE METHODS OF THE CHICAGO EDISON COMPANY.—EXTERIOR OF THE EDISON BUILDING.

GENERAL ARRANGEMENT.

The attention of the passer-by will very likely be attracted by the solid three-story edifice, with its heavy arches, snugly ensconced beside the towering Home Insurance building. Pleased with the dignified exterior of the Edison building, Fig. 1, he enters the hall, Fig. 2. At his left he may enter the supply show room, Fig. 3, wherein are displayed, on the walls, in symmetrical and artistic fashion, samples of the many switches, cut-outs, sockets, lamps and other details used in the electric lighting and power industry. On the table in the center of the room is exhibited a full line of electrical heating devices, chafing dishes coffee-pots, sad-irons and numerous fan motors and battery outfits for operating them. The purchaser may, therefore, look over at his leisure the samples of the various articles for sale, and having satisfied himself as to his desire, acquaint the sales clerk, who takes his order and attends to the delivery of the goods.

Immediately in the rear of the show room is the large store room, 40 by 150 feet, in which one finds quantities of all the articles shown on the sample board, arranged neatly and compactly on shelves, bins and racks. Heavy materials, such as cable, underground coupling boxes, lamp barrels, etc., are found in the basement below, access to which is had by stairs and also by the freight elevator in the rear, Fig 4.

At the right of the entrance hall is the purchasing agent's office, Fig. 5, and directly in the rear of it are the offices of construction department and the underground department, with a special passage going through to the rear of the building for the workmen to enter and leave the offices.

Taking the electric passenger elevator in the front hall, Fig. 6, the first landing brings the visitor to the offices of the president and the secretary, Fig. 5, which are separated from each other by an outer office. In the office of the president the meetings of the board of directors take place. An interesting feature of the president's office, shown in the central view in Fig. 5, is the center table, the top of which contains a large map of the city of Chicago, covered with glass. Upon this map, shown greatly reduced in Fig. 7, is marked the entire system of underground conductors of the company—the high pressure alternating, the Edison three-wire, the series arc and the 500 volt power conductors being marked in lines of different colors so that they may be readily distinguished. The various central generating stations of the company are marked upon the map, so that a comprehensive conception of the extent of the system and territory covered by the company is obtained at a glance. The map is always kept corrected up to date, new lines added as they are laid. On the walls of the president's office may be seen plans, elevations and sections of the Harrison street station, showing the arrangement of the generating plant in detail. At the front of the office, between the windows, standing upon a pedestal, is a beautiful bronze bust of Thomas A. Edison. Directly opposite Presidents Insull's office is the office of the secretary and treasurer, F. S. Gorton, also shown in Fig. 5.

Going from the offices of the president and secretary up a short length of stairs, the visitor reaches the second floor of the building, Fig. 2. At the right is the accounting department, the space for this department being divided into offices for the cashier, assistant to the comptroller, paymaster, credit clerks, and for general book-keeping. At the left is the electrical engineering, canvassing and inspection departments, where the general business of the company with its customers is transacted. The arrangement of this floor is shown in the views grouped in Fig. 2.

At the end of the hall, between the electrical engineering and accounting departments, is the office of the meter superintendent, with the setting-up, testing and weighing rooms in the rear.

On the third story, fronting on Adams street and immediately overlooking the engineering, canvassing and accounting departments, are the offices of the electrica

engineer, general superintendent and comptroller, shown in Fig. 5.

ELECTRIC ELEVATORS.

The building is equipped with two electric elevators, both of which are herewith illustrated. The one in front, Fig. 6, is a handsomely finished Crane passenger elevator capable of lifting 2,000 pounds 250 feet a minute. It is operated by a 15 horse power Eickemeyer motor, connected in the manner shown in the illustration. The car is provided with doors on two sides, giving admittance to offices fronting on Adams street or to the middle of the building. It runs very smoothly and gives excellent service. The combined freight

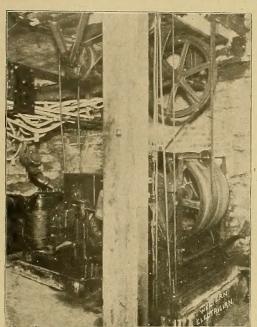


FIG. 4. SUB-STATION, DISTRIBUTION AND OFFICE METHODS OF THE CHICAGO EDISON COMPANY.—SMITH-HILL ELECTRIC ELEVATOR.

and passenger elevator in the rear, Fig. 4, is of the Smith-Hill manufacture and is equipped with a Keystone motor. It is equal in capacity to the other and fulfills every requirement.

In days gone by there was much debate of the effect of elevator motors on lighting circuits among central station men, and the question has been thoroughly studied by the electrical engineering department of the Chicago Edison company. It has been shown, however, that the lights are not affected, and the company's approval and encouragement of this service are shown by the 110 belted elevator motors, of a total horse power of 1,077, and the 40 direct-connected

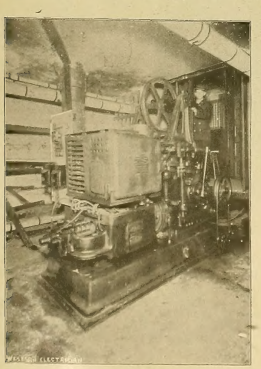


FIG. 6. SUB-STATION, DISTRIBUTION AND OFFICE METHODS OF THE CHICAGO EDISON COMPANY. CRANE ELECTRIC ELEVATOR.

elevator motors, with a total of 585 horse power, which have been connected to its circuits.

HANDLING THE WORK.

The arrangement of offices is such as to greatly facilitate the handling of the business, as well as being very convenient for the comfort of the company's patrons. The intending customer, desiring to be supplied with light or power, is visited by a soliciting agent of the company, or calls a the canvassing department and signs an application for service. This application is turned over to the credit department, and the standing of the applicant is investigated. If it is found to be satisfactory and proper credit is established, the application goes to the chief inspector, who sends an inspector to make an examination of the wiring. This inspector makes a report to his chief, and if it is of a favorable nature the chief inspector at once issues an order on the meter department to install a meter. This instrument and the necessary lamps are then put in, connection is made with the street mains and current is furnished.

DISTRIBUTING THE CURRENT.

The Adams street building is the main center of distribution for the down-town district; at this point the trunk line ends, and from it the various feeders emanate.

Under the street in front of the building is constructed a vault into which enter the 15 3,000,000 circular mil tubes constituting the trunk line. To each of the conductors in these tubes are connected three 1,250,000 circular mil rubber-covered cables, which are supported in iron racks and insulated with porcelain. Each trio of cables is connected through heavy cast terminals to the studs of a 4,000 ampere switch mounted on a marble switchboard, Fig. 8. Six of these switches are connected in multiple to the positive bus-bar and six in multiple to the negative bus-bar on the back of the switchboard. There is one switch connected to the standard neutral tube and two additional switches which are used to throw the tubes to which they are connected from the neutral to the positive or negative, as desired.

This trunk line switchboard is connected to the feeder distribution board by means of three copper bars in both the positive and negative pole, each bar having a cross section 4½ inches by seven-eighths inch, making a total cross-section area in each pole of 12.14 square inches. This bar is hard drawn and was made by the Ansonia Brass & Copper company, and it was stated by that company at the time it was ordered that it was the largest copper bar ever drawn through a die in this country. Six of these bars form the bus-bar for the positive and negative on the feeder distribution board, three in each pole.

The feeder distribution board forms a hollow rectangle, Fig. 8 (center), open at one end, the longer sides being 21 feet in length, and the short end being six feet wide. At a distance of six feet on two sides of the feeder board is a tile partition enclosing the switchboard and forming a fireproof room with an entrance door in front. There are 35 feeders in all connected to this switchboard, with a total of 105 switches and 70 amperemeters. The switches are of pure hard-drawn copper and of a special design by the electrical engineering department of the company. They are of the multiple blade type, the 400 ampere switches having a single blade and the 800 ampere having two blades, the over-all dimensions of the switches being the same in each case. The handles of the switches are of cast metal with molded rubber covering. The switches for each feeder are grouped in threes, with the ammeters directly above, one for positive and one for negative. The ampere meters are the old Edison ammeters formerly used in the Adams street station, but are converted into the edgewise type, as shown in the central picture in Fig. 8, having been rebuilt and recalibrated and provided with new cases by the company.

At the end of the room are mounted the two ammeters for reading the total output from the switchboard. There is one for the positive and one for the negative, each being of the Weston central station shunt type and reading to 15,000 amperes each. There is also an amperemeter graduated to 4,000 amperes connected to the neutral conductor of the trunk line, by which is shown the balance of the system and indicating the direction of flow of the neutral current at all times. The neutral current is extremely small, averaging only about 50 amperes, and under maximum load of 33,000 amperes on the positive and negative the neutral current is ordinarily only 150 amperes. Under the ammeters are mounted two voltmeters connected to a 150 point switch. To the switch are connected the pressure wires from the various feeder ends, so that the pressure at the junction boxes may be taken at the switchboard. There are also other special switches, by which various combinations of pressure wires may be made, so as to allow taking the pressure for 24 hours on any feeder end, by recording voltmeters, and also so that any feeder may be made the standard feeder at will.

The material of the switchboard is white Italian marble 1¼ inches in thickness and supported by a steel frame.

1. General Counting Room.
2. Main Hall on Second Floor.
3. Canvassing and Electrical Engineering Department.
4. Lower Hall and Staircase.

FIG. 2. SUB-STATION, DISTRIBUTION AND OFFICE METHODS OF THE CHICAGO EDISON COMPANY.—INTERIOR VIEWS.

All of the connections are upon the back of the board (see bottom view, Fig. 8) and are made by means of pure hard-drawn copper studs and nuts, no soldered joints being used.

From the back of the switchboard the cables lead to the front and rear of the building, where they connect with the underground tube feeders. These cables are of stranded copper, 500,000 and 1,000,000 circular mils, wound with pure asbestos cord, covered with light linen braid and painted with asbestos paint. They are supported in cast-iron racks of a special design and insulated by a special porcelain insulator. The cable conconstruction, as well as the switchboard, is absolutely fire-proof, and neither overheating or flame could injure it. A current of 11,000 amperes has been passed through the neutral cables of 3,000,000 circular mils in this building for 10 minutes without any apparent injury to the cable. There is absosolutely nothing used in the electrical equipment which could burn or carry fire. The pressure wires are carried from the tube ends, where they enter the building, to the switchboard by means of three 60 conductor cables in lead casing, like poles being in each cable.

## METER DEPARTMENT.

In the office work of a great central station there is no more interesting or important department than that devoted to the measurement of the current delivered, upon which the customers' bills are based. The electrolytic method is largely used by the Chicago Edison company, and the work is very carefully systematized.

The meter department is located in the rear portion of the second floor of the building, occupying the space which was formerly the upper boiler room for the mechanical portion of the work, and having a large room in the central portion of the building in addition. This department is illustrated by the four views in Fig. 9, (p. 7,) to which the reader is referred The central room is the office of the superintendent of the department, and of his book-keepers, clerks and inspectors. Neatly finished in oak and furnished with conveniently are ranged desks, tables and filing cabinets, its appearance is indicative of the method and thoroughness of the work carried on. Here are kept all of the records belonging particularly to this department, and an elaborate system of book-keeping and filing enables the searcher to find without delay any of the numerous "record cards," "weight sheets" and other sheets which are used in keeping record of the process gone through in reading the meters of the five or six thousand consumers of electricity connected with the company's mains. In one corner of the room is a vault for the filing cases, containing the original records of every meter reading taken since the organization of the company. A polished oak display board on the wall of the office supports samples of the various meters used, both mechanical and chemical, all equipped and connected so that the snap of a switch throws a load upon them, consisting of incandescent lamps which are ornamentally arranged upon the same board. Glass doors and cases permit a full examination of all parts of the meters.

In the rear of the office and opening directly from it is the main room for the mechanical work of the department; it is a large room with a high ceiling supported by iron columns and floored with concrete. Its whitened walls throw back the light of two 2,000 candle power arc lamps, making the room extremely bright and revealing the neatness of all its details.

Opening from the east side of this room, consecutively from south to north, are the lavatory and bathrooms, the testing room, the meter storeroom, and the grinding-room, while at the north end is the scale-room and rear elevator entrance. Of these rooms the testing room is the most interesting. This is a large, well lighted room about 15 by 20 feet in size. Three sides of it are occupied by cabinets, working benches and testing tables, while on the fourth side are the entrance and a window opening into the main meter-room, through which the meters are given out; also on this side of the room is a Barnes power lathe driven by a one-half kilowatt Edison motor with controlling rheostat so that any desired speed can be obtained. The workbench is on the opposite side of the room. On this is a small jeweler's lathe, also electrically driven by a one-twelfth horse power slow-speed Edison motor. Racks and carefully labeled cabinets before and at the sides of the bench contain every tool and material that may be required. Another side of the room is devoted to the testing tables. No locomotive engineer in his compact cab has any better control of the situation without moving from his seat than the expert operator who sits or stands before this testing table. Upon the wall against which it stands, and just above the table, is a small switchboard of white marble, upon which are mounted three single-pole throw-over knife switches. On one side of this is a Weston ammeter and on the other a Weston voltmeter, while about the edges of the board in pairs and threes are heavy copper binding posts, apparently a very simple affair and yet enabling the operator to have at his service instantly alternating current of 50, 100 or 1,000 volts, and direct current of any desired intensity up to 500 volts. Above the board is a small bank of lamps for resistance, but when varying currents are desired water resistances are used. These are to the right of the test table and are made as follows: Two large plates of sheet lead about 30 by 18 inches in size are rigidly held together at a distance of one-half inch by rubber bolts and wash-

1. Purchasing Agent. 2. Secretary and Treasurer. 3. Electrical Engineer.
4. President. 5. Construction Department. 6. Comptroller.
7. General Superintendent.

FIG. 5. SUB-STATION, DISTRIBUTION AND OFFICE METHODS OF THE CHICAGO EDISON COMPANY.—GLIMPSES OF OFFICE INTERIORS.

ers. These plates are suspended in an ordinary alcohol barre which is filled with slightly acidulated water. The plates are connected by flexible conductors and lines running to the test table, and, by means of a cord passing over pulleys to a brake wheel with friction stop situated directly beneath the table, the operator can raise the plates from the barrel or lower them into the same, and thus obtain any desired current from one-half to 150 amperes without leaving his seat. Two of these resistances are neatly cased in, and all the arrangements of the switchboard are such that two operators can work at the same time and independently of each other. At the left of the test table is a tall case, behind whose glass doors can be seen the various voltmeters, ammeters, dynamometers and other instruments needed in careful laboratory work.

In one corner of the room is a fine Wheatstone bridge and reflecting galvanometer. An arc lamp of simple construction has been arranged before the galvanometer, so that a brilliant beam is reflected to the opposite wall of such intensity that even on the brightest days it is not necessary to darken the room at all when using the bridge. The room is also equipped with a sink and a cabinet of chemical reagents, so that any ordinary test in that line can be made. All meters used by the Edison company, both chemical and mechanical, are carefully tested in this room and corrected if found in error, before they are sent out. Here, too, is done the repair work necessary on all Thomson wattmeters which are used throughout Cook county.

Without describing in detail the other rooms connected with this department, we [illegible] general character can be inferred from their name[illegible] of interest to give a brief description of the Edison [illegible] and the process gone through in reading it.

The Edison chemical meter is based upon the experimentally ascertained fact that one ampere of current passing between zinc plates immersed in a solution of a certain that metal will in one hour deposit from one plate upon the other 1,224 milligrams of zinc. The current may vary in any manner, provided that the total amount is the same; the loss is always the same. As the consumption of zinc would be enormous were all the current used in commercial purposes passed between zinc plates, this has been avoided in the Edison meter by the use of shunts. In the three-wire meter two-low-resistance shunts, one for each outside wire, the neutral not being introduced into the meter, carry the main current, while in multiple with each of these is a high-resistance shunt carrying only about one-thousandth of the current. In series with this high resistance shunt, or forming a part of it, is the meter bottle containing two zinc plates in a solution of zinc sulphate. Two meter bottles and resistance spools are placed in multiple with each low resistance shunt, so that two entirely independent readings are taken in each meter, giving a check on all results obtained. It will be readily seen that since the transfer of zinc is directly proportional to the amount of current passing, the total current can be easily figured if a certain fraction of the current has been accurately determined, this fraction, of course, being inversely as the ratio of the resistance of the high shunt to the total resistance.

The preparation and placing in the meter of the meter plates and the collection of the plates constitute the mechanical work of the meter department. The meter plates are made of cast zinc one-eighth inch in thickness and varying in size from a side area of one-half to one of 12 square inches, according to the capacity of the meter in which they are used. From one end of the plate extends a copper contact rod of about No. 10 gauge. The preparation of these plates for use is quite elaborate. First, they are taken to the grinding room and given a smooth, fresh surface on electrically driven sandpaper wheels; then the rods must be painted near the plate with black asphaltum varnish to prevent any action on them. The plates are now amalgamated, and having been freed from any surplus mercury by a rapidly revolving brush of soft bristles, are set away in racks to dry. When dry the plates are given a smooth polished surface on a revolving steel wire buffing brush, and the rods, having been cleaned on the same brush, are repointed on a sandpaper wheel. The plates are now ready for the scale-room, where they are carefully weighed on delicate balances, which easily detect a variation of five milligrams in weight. Four of these scales are kept in constant use and every plate is weighed twice before going out, so as to prevent the possibility of error. To each plate is fastened a tag, on which is the name of the consumer, the number of his meter and the weight of the plate. The weight of the plate is also entered on the customer's meter card, which is kept on file in the department. The plates are now taken to the main meter room, where each weighed plate is set up with a corresponding negative plate which has not been weighed, the losing plate only being weighed. The plates are fastened together at a uniform distance of one-fourth inch from each other by hard rubber fitting. They are now put in the meter bottles, or tumblers as they should rather be called from their shape, and the bottles are filled with a solution of zinc sulphate. This solution is made from chemically pure sulphate of zinc dissolved in distilled water obtained from a still operated in the meter room. It is tested with a delicate hydrometer to a standard specific gravity so that its resistance is always the same. The bottles, having been filled with this solution, are fitted with large corks, through which protrude the rods from the plates; the tag is left hanging over the side of the bottle. All that remains now is to put the bottles in carrying cases and place them in the meters, in which contact is made with the plate rods by means of copper spring clips. At the same time the bottles which have been in the meter the previous month are taken out and brought back in the same case in which the new ones were carried out. The old plates are then "knocked down," as the term is, and after they have become thoroughly dry, are again weighed. These weights, together with the outgoing weights of the same plates, are entered on weight sheets, and from these sheets the amount of current consumed is figured on the customer's meter card, on which the outgoing weight has already been entered when the plates were first sent out. The gross bills having been figured on these cards, and the re-

1. General Stock Room. 2. Sample Room for Electrical Supplies.

FIG. 3. [illegible]ES, DISTRIBUTION AND OFFICE METHODS OF THE CHICAGO EDISON COMPANY.—MERCHANDISE DEPARTMENT.

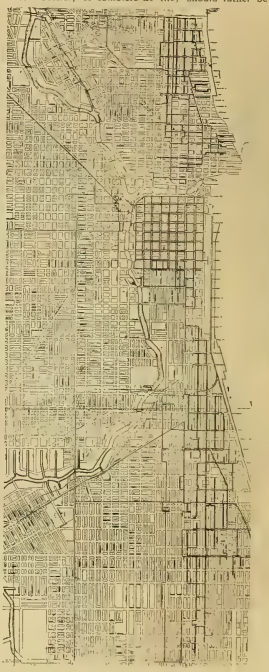


FIG. 7. SUB-STATION, DISTRIBUTION AND OFFICE METHODS OF THE CHICAGO EDISON COMPANY.—MAP SHOWING EXTENT OF STREET CIRCUITS.

sults having been carefully checked, they are copied on billing sheets and sent to the accounting department, the work of the meter department ending with the rendering of the meter readings.

The process of reading an Edison meter is rather complex; but for durability and utility of results the meter is unsurpassed, and where the reading of them has been reduced to such a system as with the Chicago Edison company, it is not found more expensive than the reading and necessary inspection of the more delicately constructed mechanical meters.

STATISTICS OF SERVICE.

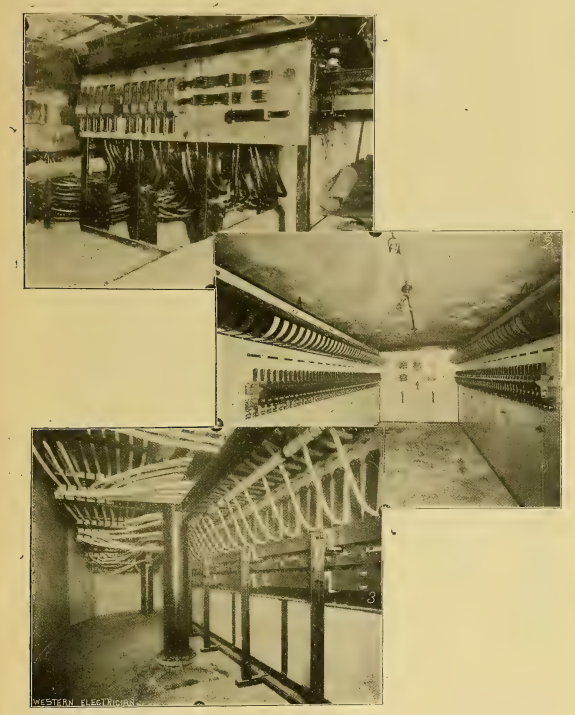
The map, Fig. 7, well indicates the extent of territory covered by the street conductors of the Chicago Edison company. Between 400 and 425 miles of circuits are comprehended in the low-tension, series arc, alternating and 500 volt power systems. Some additional statistics will be interesting. On December 21, 1895, there were connected with the company's mains translating devices as follows:

| | |
|---|---|
| Incandescent lamps of 16 candle power | 191,074 |
| High tension arc lamps (500 watts) | 1,854 |
| Low-tension (ten ampere) arc lamps | 1 332 |
| Low-tension (six ampere) arc lamps | 1,366 |
| Horse power in motors | 5,546½ |

Figuring this output as all required for incandescent lights, it reaches the imposing total of 314,329 16 candle power lamps.

On the map the full extent of the Milwaukee avenue line is not indicated. On this street the system of distribution is of particular interest, and although perhaps somewhat outside of the scope of this article, a few words of description may be permitted. Alternating current is used on this street, distributed from the transformers on the three-wire system. In a distance of two miles there are four large transformers; the primary circuits are two-wire at 1,150 volts, but the secondary wiring is on the three-wire system, with 104 volts on a side, precisely as on the direct current low-tension system. This use of the three-wire system for alternating secondaries is found to be entirely satisfactory, and is capable of great expansion.

Another new and interesting feature of the underground service is the tie line running from the Edison machines in the Market street station to the North Side station at Clark and Oak streets. This line is 9,000 feet long and can carry 400 amperes on a three-wire Edison cable at 200 volts pressure on each side. The conductors have an area of 600 000 circular mils. This tie line necessarily crosses the Chicago river. The portion in the river-bed is 400 feet long, and consists of iron armored cable having conductors of 1,000,000 circular mils. This tie line unites in one network the company's street mains from Lincoln Park on the north to Thirty-ninth street on the south—a distance of over seven miles. By its use the company expects to be ab'e to shut down the North Side station in summer every day from 1 A. M. to 4 P. M., the light load being taken from Market street. Current can also be sent through the tie line to help out the North Side station at times of maximum load, doing away with the necessity of installing additional machines.




1. Trunk Line Switchboard (under sidewalk). 2. Feeder Distribution Room.
3. Back of Switchboard (Feeder Distribution Room).

FIG. 8. SUB-STATION, DISTRIBUTION AND OFFICE METHODS OF THE CHICAGO EDISON COMPANY.—DISTRIBUTING THE CURRENT.

PERSONNEL.

The chief officers and the directors of the Chicago Edison company are:

President—Samuel Insull.
Vice-president—J. W. Doane.
Secretary and treasurer—Frank S. Gorton.
General superintendent—C. H. Wilmerding.
Comptroller—W. M. Anthony.
Electrical engineer—L. A. Ferguson.
Purchasing agent—Charles Holmes.
Directors—J. W. Doane, A. A. Sprague, R. C. Clowry, Edward L. Brewster, A. F. Seeberger, Robert T. Lincoln, Erskine M. Phelps, Byron L. Smith, Lambert Tree, Joseph Leiter, Frank S. Gorton, Samuel Insull.

The business of the company is conducted in an orderly and dignified manner, yet titles and distinctions are not allowed to interfere with the one object of the company's endeavor—the constant improvement of the service in quality and quantity. This is realized by all, and the result is a direct, practical, business-like administration. Mr. Insull has general executive charge of all the affairs of the company; Mr. Wilmerding takes under his care the operation of stations and all underground work; Mr. Anthony has supervision of the accounts; Mr. Ferguson is in charge of the electrical engineering and the procurement of central station and isolated business and its supervision; Mr. Holmes, who has been with the company over 14 years, is responsible for merchandise sales and purchasing.

## Comprehensive Canadian Electrical Project.

The Dominion of Canada is quite aroused, in railway and electrical circles, by a legal notice appearing in Canadian papers stating that application will be made at the next session of Parliament for an act to incorporate "The Canadian Electric Railway and Power company, with power to build, operate and maintain an electric railway from the city of Montreal in the province of Quebec to the city of Windsor in the county of Essex, via Brockville, Kingston, Belleville, Toronto and London, with power to build a branch line to Suspension Bridge (Niagara Falls), with power to build branch lines for a radius not exceeding 25 miles from any point or points on the main line; to enter into contract and arrangements with all existing or authorized firms or corporations along the said route, particularly with existing street or electric railway, light or power companies for the purpose of acquiring, leasing, amalgamating or making running arrangements with same, or to supply same with heat, light or power; to establish, maintain and carry on street railway services in such cities and towns on the line of said railway as the company and municipalities interested may agree on; to build said railway in sections as may be authorized; to acquire water powers and sites for and build electric works in connection with said railway for the purpose of generating electrical energy; to acquire the right of way to transmit and also the right to sell and otherwise dispose of electrical energy for heat, light, power and other purposes and to distribute the same; with power to expropriate lands for the purposes of the undertaking as provided by the Railway Act; with all other powers necessary for constructing and operating the said electrical works, and otherwise fully carry on the said undertaking; with power to issue paid-up stock of the company in payment of its obligations for all or any of the said authorized purposes, and with all proper or usual powers given or granted to companies incorporated for any of the purposes aforesaid."

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Blue Earth Valley Telephone company is making overtures to secure an entrance into Mankato, Minn. It proposes to put in a local exchange and to give connection with northern Iowa.

The Oskosh Northwestern Telephone company of Oshkosh, Wis., expects to have its entire system in operation this week.

A local telephone company has been formed at New Richland, Minn. C. A. Wagner is president, E. C. Cram secretary, and Henry Jaching treasurer and manager.

The Forman, N. D., Telephone company has recently declared a quarterly dividend of 3 per cent.

Arrangements have been made to extend the telephone line from McMillan, Wis., to Marsh Rapids, six miles, connecting on the way with two of McMillan's lumber camps.

Seattle, Wash., now has 921 telephones in use. The company is putting in exchanges at Everett and Whatcom, Wash.

Royalton, Minn., is connected by long-distance telephone with Little Falls, Minn., and through that office with the Twin Cities.

A. F. Cutter, secretary of the Iowa Union Telephone company, says that his company will have long-distance connection from Chicago and New York to Omaha, via Davenport, and that work will be completed through Illinois in 1896. The line through Iowa to Omaha may not be completed in 1896, but it will be only a matter of a little longer when it will be.

A resolution was introduced in the city council of Winona, Minn., ordering the Northwestern Telephone company to remove all its instruments from the city offices, buildings, fire and police stations, and instructing the superintendent of fire alarms to remove them in case the company did not within a certain length of time. The motion was adopted.

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CORRESPONDENCE relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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HIGH WATER MARK
CIRCULATION, 16,630.

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SOME of the readers of the WESTERN ELECTRICIAN will receive this, the initial issue of 1896, on the first day of the year. To them and to all other members of our constituency we extend a hearty greeting. A Happy New Year to you all! May all our subscribers find themselves advanced at the close of the year in all things intellectual and material; may our advertisers do a greatly increased business—and we will help them to do it; may our esteemed contemporaries, laboring with us for the diffusion of electrical knowledge and the expansion of the electrical industry, prosper as never before (yes; the *Electrical World*, too—may the Almighty endow it with sense and manliness). Let us all take courage on the threshold of a promising year. Old Eighteen Ninety-five was not all that the electrical fraternity might have asked; but it might have been much worse. This year is sure to show a great improvement, or all signs are misleading. It will mark the firm upholding of the Monroe Doctrine, but without war; it will witness a presidential election and a marked betterment of business; it is a leap-year, and the last to be thus distinguished for eight years. We are entering upon a bright, promising, and, in many respects, a remarkable year. Hurrah, then, for 1896!

The WESTERN ELECTRICIAN will continue to issue the best electrical paper that it knows how to produce. We can point to our past record as an earnest of continued performance. New features are in contemplation that will make the paper better than ever before. The needs and progress of the Great West, from an electrical point of view, will be carefully and fully recorded, and every effort will be made to make this journal still more representative and worthy of the field it occupies.

THERE should be a rigid investigation of the recent accidents on the Metropolitan "L" road of Chicago, in which it is reported that the cars became uncontrollable. If the motors, controllers or brakes refused to act properly, the cause should be promptly ascertained. There can be no good excuse. Perhaps the human equation will be found at fault.

AN ambitious Canadian electric railway project is chronicled on another page. An electric line connecting Montreal and the chief cities of the Province of Ontario would be a very noteworthy piece of railway engineering indeed. In addition, the promoters seem to figure on doing all the other electrical work of the country traversed. As at present outlined, the plan can hardly be taken seriously.

THE article on the distribution and measurement of the current furnished by the Chicago Edison company, which forms the leading feature of this week's issue, will be found to be of general interest. This company is the second electric lighting company in the country in the magnitude of its operations, and its experience as to best methods of operation cannot fail to be of value to all interested in electric lighting. The portions of the article devoted to the feeder distribution and meter department will be of the greatest interest to the student, while the general methods of operation and the statistical information will be of especial importance to him who devotes himself to the commercial side of the business.

WE have called attention to the dissatisfaction which business men have manifested because they have been obliged to furnish lights for the streets in front of their places of business at their own expense, and we have also alluded to the alarming prevalence of crime in the streets of Chicago, made possible by the failure of the city to properly illuminate its thoroughfares. Now, another objection is raised, and it is one that cannot be permitted to pass unheeded. The *Chicago Tribune*, of recent date, contained the following news item:

> Electric lights in the vicinity of Rush street bridge went on a strike at 6:30 o'clock last night and caused considerable inconvenience. The south approach was enveloped in darkness, and vehicles frequently collided, but no serious damage was done. Pedestrians groped their way through darkness and mist with timidity.
>
> Those who are acquainted with the locality will at once recognize the importance of the situation thus presented. To jeopard the lives of the thousands of citizens who pass that point is a terrible responsibility, which should appall even John P. Barrett.

THE report of the Institute discussion on the use of storage batteries shows that the accumulator men made a good showing. Messrs. Leonard and Perry were incredulous, but, on the whole, the other side appears to have had the best of the argument. There is certainly a use for storage batteries in central station work, and Mr. Childs cited a very striking incident in Boston, where the use of reserve current at a moment's notice was very beneficial. A gas engine reserve could have been pressed into service in such an emergency, but not so quickly. An English contemporary justly remarks that, "In very large cities the use of the storage battery can easily be justified, for it is important to remember that the energy they accumulate during the day is obtained from steam power that must be kept going, and but for the storing of part of its energy would be even more wasteful. In fact, energy stored during periods of light load may be so much waste prevented, and, to a certain extent, the peaks of a night load are covered by energy that would otherwise have been lost." We think that Mr. Perry has taken a rather extreme position in assuming the attitude of invariably recommending the gas engine at the expense of the storage battery, and that local conditions may obtain which will be favorable to each.

THE electrical fire hazard is a fruitful topic of discussion abroad as well as at home. In London, however, it does not excite alarm, or ought not to, if the figures given by Major Flood-Page in the *Times* are correct. This authority quotes reports to show that, in 1894, the causes of fires in the metropolitan district were: Candles, 157; gas, 284; lamps, 470; electricity, 3. This is a most favorable showing —better, perhaps, than could be made in any large American city, although we have not the figures at hand. Major Flood-Page is not, however, altogether easy in mind. He views what he fears is an impending danger, and he explains himself as follows:

> I view with some alarm the efforts of some electrical engineers who are advocating an increase, and in some instances actually increasing the pressure at which they deliver the current of electricity, to 220 volts, while the ordinary current has been 100 to 110 volts. It is supposed by some that a difficulty has arisen in the manufacture of incandescent lamps to meet this demand. Permit me to say that the lamp presents the smallest difficulty in connection therewith. A far more serious question, and one which touches very closely upon fire insurance, is whether houses wired with fittings and switches manufactured for 100 volts can safely carry 220 volts. It stands to reason that before this change can be made every house must be inspected—switches, wiring and fittings thoroughly tested and examined. I have no hesitation in expressing my own opinion that it is far better that we should, for many a day yet at any rate, be content with the useful safe pressure under which we have obtained the most satisfactory reports which these figures of the Metropolitan Fire Brigade show in connection with fire risks and electric light.

Considerable attention is now being paid in England to the subject of 220 volt lamps, and the views of the alarmed major are not shared by the majority of British electricians.

NO ONE will deny that the use of storage batteries affords the ideal means of electric traction. For one thing, it will take away a large share of the occupation of the calamity howlers. Think of a time when there will be no "deadly trolley" to lie about!—no weary routine of "falling wires," of "hampered firemen," and of "danger to life and property" in the sensational press! If that time shall come, all sensible persons will experience a sense of grateful relief. Of course a storage battery car going at a rapid rate will be just as liable to the accident of colliding with an inactive pedestrian as a trolley car; perhaps more so, as a couple of tons of cells on the trucks will make it heavier and possibly less responsive to the brakes than the trolley car. Nearly all the "trolley car accidents" paraded in the daily papers are casualties of this sort, and so, in sober fact, the storage battery car will be as "dangerous" as the maligned trolley car. The danger of street collisions will always remain as long as the American people demand transit by means of rapidly moving cars on the surface of populous highways, whether the motor be actuated by steam, gas, compressed air or electricity in any form of application.

Nevertheless, the storage battery is ideal. No smoke from boilers, no odor from oil motors, no puffing of engines or "singing" of wires, no cumbrous and inartistic overhead construction, no overhead conductor to become covered with sleet or conduit to collect water and dirt, no dependence on a remote source of power—the advantages of the system are obvious by contrast. Let us have the battery car, then, by all means, if it is practicable. Unfortunately it is just at this point that our pleasurable anticipations are overcast by the gloom of doubt. Is the system practicable? With all its advantages, why is not the storage battery in extensive use on street railway cars?

To a limited extent storage battery cars have been operated in Paris and in the capital of this country, and numerous experiments have been made elsewhere. However, no large American street railway system is operated by accumulators on the cars. Numerous mechanical difficulties have been encountered—the time taken to charge the cells, the necessity of replacing the discharged battery at the power house with a freshly charged set of cells after, say, 10 hours' run, but, principally, the great weight of the battery on the car, it having been found impracticable to run a large car, loaded with passengers, up a steep grade. What, the first cost and operating expense of the equipment are such, it is charged, as to prohibit the success of the system from a commercial point of view. The situation, then, is that electrical men generally agree that the introduction of storage battery cars would mark a welcome improvement in surface transportation in cities, but they doubt, in the present state of the art, the commercial possibility of such a step.

In this state of affairs it is gratifying to observe that the experiment of operating a storage battery road is to be again tried—this time under the indirect auspices of a great manufacturing company that will hardly fail to make the trial exhaustive and thorough. The franchise of a Chicago suburban railway has been purchased by a company in which the stockholders of the principal storage battery corporation of the country have a controlling interest. This road is to be equipped with storage battery cars and, with a roadbed absolutely level and the latest improved type of accumulator cell, the promoters confidently predict success. Some startling claims are made as to the rate of charging the batteries in point of time, and the results will be awaited with interest. We hope that the new company will persevere in its announced determination and give the public the results of its experience.

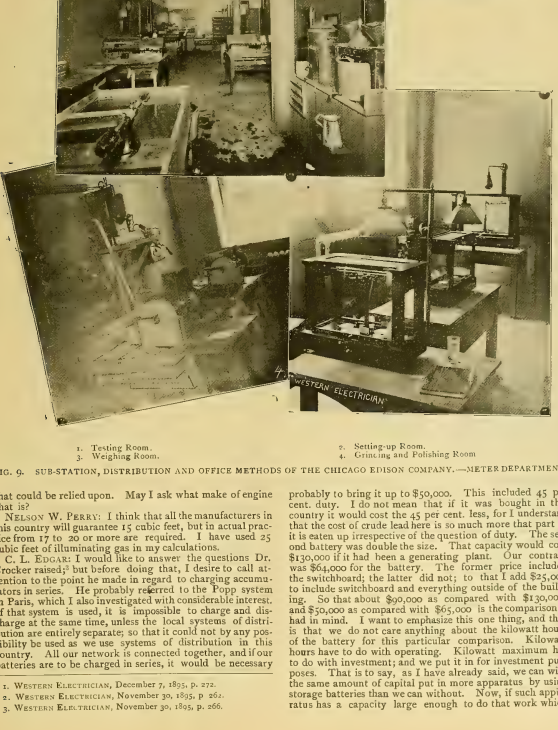
## Storage Battery Discussion.

So far as it has been received from the secretary of the Institute, the discussion before the American Institute of Electrical Engineers on the communications recently read before that body, having for their subject the use of the storage battery, is substantially as follows:

TOWNSEND WOLCOTT: I would first of all like to say that Mr. Edgar's communication[1] is very important from the fact that he tells us what has actually been done with the storage battery. That is just exactly what we wanted. Instead of saying that such and such things can be done with the storage batteries, he says such and such things have been done.

In regard to Mr. Perry's communication[2] the point that I wished to raise was in connection with the gas engine. It seems to me extraordinarily good work for gas engines, this consumption of 15 feet of gas per horse power hour. I heard of a gas engine that ran 17 feet, but I learned by inquiring around that it was not a very durable engine or one to have two entire sets. This seemed to me to be the principal drawback of the system there, and it prevented its extension. It is impossible to keep the circuits entirely free from grounds, and the results would be that one system would have one voltage as compared with the ground, and the next another, and the next another, and it might go up to two or three thousand volts.

In regard to the question he asked in respect to cost, I have not the slightest objection to giving exact figures which will show upon what I base my statement. In the old type of station it was usually customary to figure that the entire steam plant outside of the real estate and the buildings—by steam plant I mean the generating plant in general—cost from $50 to $60 a horse power. With the new type, high economy plant, it costs from $90 to $100 a horse power. In our own experience we find that almost exactly true. In regard to batteries, our first battery was put in to give out 1,650 amperes on each side of the system. A 650 horse power generating set gives out 1,333 amperes on each side. This, as a steam plant, would have cost $65,000. Our contract was for $44,000, and there were enough incidentals




1. Testing Room.
2. Setting-up Room.
3. Weighing Room.
4. Grinding and Polishing Room

FIG. 9. SUB-STATION, DISTRIBUTION AND OFFICE METHODS OF THE CHICAGO EDISON COMPANY.—METER DEPARTMENT.

that could be relied upon. May I ask what make of engine that is?

NELSON W. PERRY: I think that all the manufacturers in this country will guarantee 15 cubic feet, but in actual practice from 17 to 20 or more are required. I have used 25 cubic feet of illuminating gas in my calculations.

C. L. EDGAR: I would like to answer the questions Dr. Crocker raised;[3] but before doing that, I desire to call attention to the point he made in regard to charging accumulators in series. He probably referred to the Popp system in Paris, which I also investigated with considerable interest. If that system is used, it is impossible to charge and discharge at the same time, unless the local systems of distribution are entirely separate; so that it could not by any possibility be used as we use systems of distribution in this country. All our network is connected together, and if our batteries are to be charged in series, it would be necessary probably to bring it up to $50,000. This included 45 per cent. duty. I do not mean that if it was bought in this country it would cost the 45 per cent. less, for I understand that the cost of crude lead here is so much more that part of it is eaten up irrespective of the question of duty. The second battery was double the size. That capacity would cost $130,000 if it had been a generating plant. Our contract was $64,000 for the battery. The former price included the switchboard; the latter did not; to that I add $25,000 to include switchboard and everything outside of the building. So that about $90,000 as compared with $130,000, and $50,000 as compared with $65,000 is the comparison I had in mind. I want to emphasize this one thing, and that is that we do not care anything about the kilowatt hours of the battery for this particular comparison. Kilowatt hours have to do with operating. Kilowatt maximum has to do with investment; and we put it in for investment purposes. That is to say, as I have already said, we can with the same amount of capital put in more apparatus by using storage batteries than we can without. Now, if such apparatus has a capacity large enough to do that work which actually exists, we can actually save money by equipping one-third of our stations with battery and two-thirds with steam. I do not mean to say that considering the question of kilowatt hours in general, for traction purposes, or for all the incidental purposes, that batteries are of course not very much more expensive than steam plants, and I tried to make this statement with particular reference to that special use of the battery.

Now, in regard to efficiency, our guaranteed efficiency is 75 per cent. I never have understood that a high rate of charge and discharge was going to interfere with the efficiency of the battery. It is undoubtedly going to cut down the capacity. With an hour-and-a-half rate of discharge, the battery has only two-thirds of the capacity that it has at four, five and six hours discharge. The efficiency is the same, and I feel quite sure that the manufacturers claimed that we would get higher efficiency if we charged and discharged at maximum rates than if we did not. I personally know nothing about that, except what I am told.

There is another point that Dr. Crocker made, which appealed to me in exactly the opposite way from what it did to him, and that is the English practice of running a large number of small engines as compared with the German practice of using two or three very large ones. It was that particular thing that appealed to me for the value of the storage battery. When we realized that with the same type of engine, if you put in a 200 horse power engine and one of 800 horse power, you naturally get 10 per cent. better efficiency out of the large one, from the nature of its construction, and that the small engine is likely to run 15 to 18 hours a day; you will find that the inefficiency caused by the small engine is very much greater than the 25 per cent. battery inefficiency run for only two hours a day. So that the actual economy of these small engines running under the best possible conditions is less than the economy of the large engines run under the best possible conditions and a storage battery of 75 per cent. efficiency.

Then in regard also to the question of guarantee. I know nothing about what the American company guarantees. I have never asked the question. Our guarantee was for 6 per cent. of the cost of the cells. On the $44,000 contract I think the cells were put in at about $29,000. In the $64,000 contract the cells were put in at $59,000, so we are paying 6 per cent. on $59,000 worth of investment. There was a clause in the contract that if an American company was established, this should be reduced to 4 per cent., because this was done in Germany. I was informed by the manufacturers abroad that they were always willing to give a guarantee of 4 per cent., but that at least 75 per cent. of their customers refused it on the ground that it cost them but three.

H. WARD LEONARD: There is one use for storage batteries which has not been touched upon particularly, and which to me is perhaps one of its best applications, and that is in connection with the regulation of the speed of the motor, such as would be required for the operation of, for instance, elevators or street cars, as giving an abundance of means of securing variable electromotive forces for various speeds, and for reversals of direction. The point about storage batteries which is often raised to explain why the progress has been rather slow in this country has been the patent litigation, but I look upon that as merely an excuse for the slow development of an article which has not had a demand sufficient to develop it. I do not believe any really meritorious article has been in the electrical field thus far which has been retarded in its progress by litigation, and the progress of the litigation which we have seen in the case of incandescent lamps, systems of distribution and electric street cars, while it may have cost a great deal of money for the litigants, as it unquestionably has, I do not think has tended to retard the progress of development—rather the reverse. In the case of storage batteries, the demand has not existed and their use has not given success, and that is the sole reason for the fact that they have not been used. As regards the cost per kilowatt, which is very largely the essence of the question involving economy, it seems to me that the figures that I have seen quoted, which make a favorable showing for the storage battery, take the maximum rates of discharge for the batteries that it is deemed safe to operate them at, and have taken the horse powers of the engine at one-quarter cut-off. Now I agree with Mr. Edgar that the question of development of power for the peak of the load is one which is largely independent of the economy of production as compared with that for a very large portion of the total load which is below the peak. But it seems to me that in making comparisons we should consider the cost of the horse power of steam generating machinery, when operated at its maximum load, its maximum capacity, which will certainly be 50 per cent., without unduly straining any good boiler or engine above that for which it would have for the ordinary evaporations in the boiler, and a quarter cut-off in the engine, and I think that steam plants figured on that basis can unquestionably be installed for $50 per kilowatt to-day, and ones which will be certainly more efficient in the production of a kilowatt than the development of a kilowatt by a storage battery, with the conversion losses and the lack of efficiency and capacity due to discharge at high rates. In that connection, I will say that it seems to me that it is unquestionable that there is a very marked difference in the efficiency—not only in the capacity, but in the efficiency—of the storage battery when discharging at high rates, and that a very large factor in the question of efficiency is the resistance of the battery, and the $C^2R$ loss will certainly very rapidly increase with the rapid discharge. What I would like to find out, if we can, is: What is the cost per kilowatt, when the battery is discharging at the rate for which the manufacturers guarantee the 6 or 10 per cent. depreciation which they have guaranteed, and the figures—although we have had figures that are on their face very convincing—do not give to me an explanation of the difference between the prices which we have been familiar with in the purchase of batteries and those which have been quoted. I have bought batteries and installed them almost every year since 1885, and I have never

1. WESTERN ELECTRICIAN, December 7, 1895, p. 272.
2. WESTERN ELECTRICIAN, November 30, 1895, p. 262.
3. WESTERN ELECTRICIAN, November 30, 1895, p. 266.

succeeded yet in buying a battery at a price approximating $50 per kilowatt, although of course, I have not dealt in very large units, but I have received a discount from the list, which is as favorable as I think is given to customers in this country, because the instances that I had were ones in which the manufacturers were quite interested in seeing the applications made—I could not get the batteries at less than $180 per kilowatt when operated at the maximum rate at which they would make any guarantee. I think that, judging from the price-list that we have in this country, it is impossible to expect to get batteries to compare in cost with steam plants, even when run at double the rate that they call the excessive rate of discharge, that is, even allowing that the battery shall be run at double the excessive rate. The cost of batteries, even those of the largest size—if I may judge from the prices of batteries of smaller sizes—would be at least $100 per kilowatt.

Now, one point as regards batteries in use in this country. It is a very familiar saying that we do not appreciate them over here; that they have been used abroad, and it is through a lack of interest in the matter, or a lack of appreciation of their points, that they have not been used here. But there is one thing which is very pertinent to my mind. I have been installing dynamos for a great many years, and I do not know one of them that I have installed that is not running perfectly, successfully and economically to-day and in good condition. And, as I say, I have been installing batteries nearly every year also, and I do not know one battery that is running that I have installed. That may be because I installed it, but there may also be some influence due to the fact that it is a battery. One of the best remarks about a battery that I ever heard was made by Mr. Edison to me. He said that "the blamed thing was wet," and I think that expresses a great deal electrically.

Personally, I am desirous of saying nothing except what is favorable of the storage battery, but I think that my views as to its applicability, and the reasons for applying it differ from some others. I do not think that the storage battery is likely to be installed, when considering the question of cost in the light in which I presented it, because of its economy over the steam plant in dollars and cents, but I do not think that that is the thing to be considered. I think that Mr. Edgar has expressed it very well, and we all of us know how it is of the utmost importance that the service from an electric central station shall be perfectly reliable, and that the light shall be perfectly uniform, and the question of cost of the battery to my mind, and its efficiency also, is quite of secondary importance—if by the use of the battery they obtain absolute reliability of service and perfect uniformity of the light, and cannot otherwise—and I think that the battery may be installed in a station with a net saving to the station, rather than to go without it, when viewed from this standpoint; while I do not believe in the actual saving in dollars and cents in our central stations in this country, with the character of load diagrams that we have.

The figures which Mr. Edgar gave, I should like to ask questions about, as I think I must have heard them wrong. If I understood him, he said that the cost of a single battery was $50,000, when he considered the additional features that were necessary to get it installed, and I understood him to say that the capacity of that battery was 1,650 amperes at the full voltage of outside wires—1,650 amperes on both sides; well, allowing 250 volts for the outside conductors, unless I have made some error in my hurried calculations, it would seem that that is about 400 kilowatts, and if so, that would be about $12 a kilowatt.

Mr. Edgar: One hundred and twenty dollars.

Mr. Leonard: One hundred and twenty dollars—well, that seems to correspond with my figures better than I thought it did. Since it is $120 a kilowatt, which quite agrees with my idea of the cost, I do not see why it is maintained that it is so much cheaper in first cost than a steam plant.

Mr. Edgar: I would like to say, in answer to Mr. Leonard's statement, that I do not think our battery rated at 1,600 amperes has any less factor of safety than an engine with one-quarter cut-off; that is to say, that the battery is supposed to run regularly 1,600 amperes, and the engines that were put in at that cost are supposed to run regularly 400 kilowatts. It is possible that the engine would run double that. If you had dynamos that would run 800 kilowatts instead of 400, they would cost very nearly twice as much. There is no overloading of the dynamo to anything like the extent there is of the engine. The excess power of the boiler has already been discounted in its installation. On the other hand, the battery, although guaranteed for 1,600 amperes, is said to run 4,800 for 15 or 20 minutes, if it has to, and I would not hestitate a moment to put that on if necessary. So I think the element of overloading in one is about equal to what it is in the other.

Mr. Leonard: The point which I should like to emphasize is that the guarantee has been upon a cost of $120. Of course, we all know that the batteries will give, with certain results, a very much larger rate of discharge. As to what these results will be, only the future can tell. But if they are worked at two or three times the maximum rate guaranteed by the makers, of course it is entirely at the risk of the owner of the battery, and I do not see any very good reason for supposing that they will act very differently from other batteries that have heretofore been overloaded. I do not quite agree with Mr. Edgar as to the fact that a dynamo cannot be operated during a period of half an hour or an hour, and at a very large amount beyond the amount for which it is guaranteed for continuous duty. It seems to me that in the case of large dynamos, the output could be very much increased for the matter of an hour or two without any detriment to the dynamo.

J. B. Entz: I have recently spent a year in the factory of the Tudor company in Germany, and have had occasion to know what their practice is in that country and what their results have been. They have a great many large central stations which have been installed from 10 to six years. The opinion of all engineers with whom I spoke on the subject were the same as those Mr. Edgar has expressed to-night. I have met engineers from Siemens & Halske and the Allgemeine Electricitats Gesellschaft, Schückert & Co., Oerlikon and other large companies, and whenever I started to criticize the battery in any way, they rebuked me by saying that it might be so in this country, but that the results were different there, and the results were very satisfactory. The company ships 60 tons of battery a day. In Hanover, where they have had an installation for six years, the efficiency was 83½ per cent. for the entire year's work, and the loss of engergy but five per cent. of the total output. The company sells the batteries with the capacity specified for the different rates of discharge. The customer may discharge it in one hour, two hours or 10 hours as he pleases, and it does not affect the guarantee. The purchaser has the option of taking the battery without any payment for guarantee for two years. The company keeps it in perfect repair for that time. At the end of two years the purchaser can take a guarantee from the company for 4 per cent. a year for 10 years, but very few of them care to do that. The actual expense of maintenance has been 2¼ per cent. to the company. In that time they made considerable money out of that 4 per cent. guarantee.

J. R. Williams: I would like to say that the efficiency of the battery, as Mr. Edgar stated, does not vary except within a very small fraction as the discharge rate increases; that is to say, a battery that would give a watt efficiency discharge at a 10-hour rate of 80 to 85 per cent. would still give a watt efficiency of 78 to 84 per cent. if discharged at a two-hour or a one-hour rate. The capacity would decrease as the discharge rate increased. But if you take out a certain capacity at a high discharge rate, it would only require charging to the same extent as the amount of current that had been previously discharged.

J. Appleton: There are one or two things about Mr. Perry's communication to which I would like to call your attention. He advocates the use of generators driven by gas engines for taking the peak of the load in central stations. Now in any station of a reasonable size this peak must be at least 400 horse power. In order to take this with gas engines, it must be necessary at least to have two or more engines driving generators. I would like to ask Mr. Perry if he has tried to run dynamos in parallel with gas engines of that size. If he tried it once, I do not think he would be inclined to advocate it in this way. I notice Mr. Perry begins his communication by advocating the use of gas engines for electric lighting, and then goes on to say that he does not think there is a single case in this country where they have been successful. I think this must be due to the fact that he has never tried to use them in conjunction with storage batteries. The modern gas engine, as built in this country to day, I do not think is very far behind the European gas engine. Germany is considered the home of the gas engine, but I think we are getting nearly as good results in this country now, as they are obtaining there. In fact, I know of many isolated plants which are working perfectly satisfactory with a combination of a gas engine and storage battery. Mr. Perry calls attention to the fact that in England, France and Germany a great many isolated plants and also central stations are using gas engines, but I venture to say that not 5 per cent. of the whole number are running without a storage battery in combination. Referring to his suggestion of transmitting power to outlying stations by means of gas through an iron pipe, even if the gas engine were available for taking the load in the outlying district during certain hours of the day, I think his calculations are wrong in one respect. He compares the price of the iron pipe to the price of copper mains. Now I take it that if he has his iron pipe, he must have his copper mains as well; and having his copper mains, he might just as well use them to transmit current to the outlying districts and charge the storage battery, raising the pressure by a booster.

With regard to the general use of the storage batteries in this country, I think the previous practice has been wrong in this respect. The individual conditions of each case have not been considered. When an engineer considers any particular installation, he looks to the conditions, and puts down his generating plant to suit those conditions, and it must be done in the same way with a storage battery. There are storage batteries built to-day for certain purposes which ought not to be discharged above a 10-hour rate. Then again there are storage batteries built to discharge at a half-hour rate, because for heavy work and for regulation a battery must be capable of discharging at a very heavy rate. With regard to the question of regulation, recently I have had occasion to figure on a problem where there was an output of about 2,000 horse power from one station; it was a fluctuating load, resulting in a variation in voltage of about 20 per cent.; by the application of a battery which would give about 350 horse power at a one-hour rate, it is possible to keep that fluctuation down to a total variation of two per cent., and I think that is nearly as close as most engineers want. A great many of the speakers, or some of them at least, have said that the previous storage battery plants have not been a success, and in connection with this there is one point, I think, which has been quite overlooked. A storage battery will not show signs of distress when it is very heavily overloaded. You take a case of a dynamo and battery working in parallel on a two or three-wire system; say some extraordinary conditions arise on the circuit, such as a short-circuit; the battery would take a very great deal more than its share of the load. The generators begin to kick at once. The battery will take all that is wanted; and it is this very fact of your being able to get out of a battery nearly everything you want, whether the battery is built to discharge at a high rate or not, that has been the ruin of a great many batteries in previous years.

Chas. Blizard: We do not recognize the company Mr. Perry so mysteriously describes as "the leading storage battery company of this country."

Through an oversight, unintentional no doubt, Mr. Perry does not quote from a letter under date of June 11, 1894, sent him by this same "leading storage battery company" in which the matter of maintenance is dealt with as follows:

"We will undertake to maintain installations of our accumulators when operated at normal rates upon a basis that will limit the cost of perpetual maintenance to 10 per cent. per annum upon the original cost."

If Mr. Perry had brought his communication up to date he might have quoted from the current edition of the catalogue issued by the storage battery company in question in regard to maintenance as follows:

"The company is prepared to undertake maintenance contracts under which they will guarantee that the total amount paid for renewals during the term of the contract shall not exceed 10 per cent. per annum on catalogue prices of the cells specified in the contract." The clause covering there turn of the old material being omitted.

It is generally understood that retail prices are not maintained when wholesaling.

It is not a fact that the public has been led to understand by the battery company or its representatives that the guarantee offered means anything more or less than what is distinctly stated in the catalogue, and the fact that in the letter from which Mr. Perry quotes he was referred to the catalogue for terms of guarantee is a sufficient refutation of his argument.

Mr. Perry's criticism would seem to cover the manufactured who recommends the installation of a battery of capacity suitable to the work to be done, and who asks, when giving a maintenance guarantee, that the battery be worked within its normal limits and handled in accordance with the simple rules which experience has proven produced the best results as to efficiency and durability. I fail to see the injustice or hardship involved in these requirements.

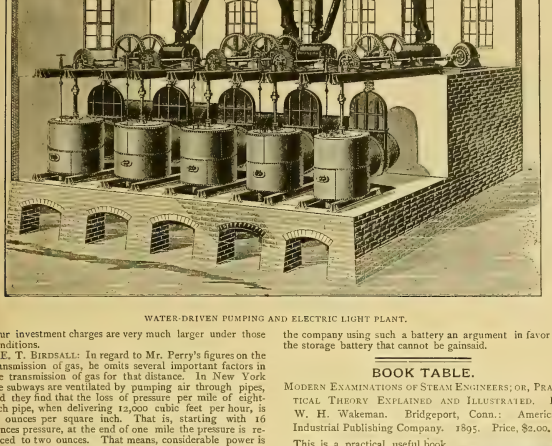
Mr. Perry's statement that the guarantee holds good when the battery is cared for in exact accordance with the instructions laid down by the manufacturer conveys the impression that an infraction of the rules would necessarily nullify the guarantee. While the selling company would undoubtedly have the right to withdraw, I do not know of a case in which such a course has been taken.

"The leading storage battery company of this country" does not anticipate that its business will be materially affected by Mr. Perry's alleged discovery of the difference between its nominal and actual guarantees.

Mr. Perry: Replying to Mr. Appleton, I believe that he was right—that in most of the applications of the gas engine abroad the storage battery is also used, as it is in connection with dynamos driven by steam engines. He speaks of the peak of the load requiring in the neighborhood of 400 horse power. The largest gas engine so far constructed, so far as I know, single cylinder gas engine, is of 375 horse power, with fuel gas; with illuminating gas it will go something over 400, perhaps 450 horse power, and it has been repeatedly stated by English manufacturers that they were ready to make gas engines in 1,000 horse power units whenever wanted. But it is customary, I understand, where the large units are employed, to use two-cylinder gas engines, so that we may have, for instance, an engine of two cylinders, each of which would separately give 200 horse power, and the explosions are so timed as to give an explosion once every revolution. There is an advantage in that since it makes the angular velocity of the armature more regular. Then in regard to the transmission of power by means of gas to an outlying station, Mr. Appleton suggested that we have the copper mains also. My idea was to supplant the copper mains with the gas mains, and while I suggested a six-inch pipe, that was assuming that we required that power continuously. With the storage battery the claim is that we may use a smaller conductor, and by charging for a long time, we can store up a large amount of energy to use when the demand is excessive. The same would apply to gas storage. You have your gasholder there, and instead of using a six-inch main to carry that energy that distance, you might use a very much smaller one, and charge your gasholder during the day, or during the hours of light loads, and your expense of transmission would be still less, and the interest on investment would be still less; and the other object in transmitting by gas to outlying stations was that the efficiency of transmission would be very much greater, at a distance of two miles even, than if you used a transmission of a thousand volts, which I suppose would be about as high as it would be proper to transmit current for the storage of energy in storage batteries.

In regard to Mr. Blizard's remark, in reading a paper before the National Electric Light association, at Cleveland, I was jumped on by a member of the leading storage battery company of this country for some of my remarks in regard to the storage battery at that time. He distinctly stated at that time, if I recollect his remarks, that the cost of maintenance, guaranteed charges, was 10 per cent. on the price of the battery, and this letter that I referred to and the catalogue—the catalogue was the one in force at that time—contradicts that statement flatly. This is the first opportunity I have had of replying to it. I have seen a later catalogue since that, and this also bases the guarantee on the catalogue prices. I also have in my possession the letter to which Mr. Blizard referred, but which I have not copied here. That letter, as I recall it now, is less specific than this one—this one being very specific—as it states here: "We send you by to-day's mail our illustrated catalogue, and would especially call your attention to the question of maintenance, as contained on page 11." That seemed to be very specific, as to what their guarantee means. Their guarantee was on the catalogue price and not on the cost price; and at that time and in that place it is stated that: "In all cases of renewal by contract, the old material becomes the property of the company and must be returned to their works free of charge for carriage or packing." Now the omission of that statement from the new catalogue does not convince me that they do not expect that. I know from the experience of some others—not my own experience—that when you ask for a battery for some particular purpose where the discharge is pretty rapid, or for some very unusual use, that the guarantee which they offer you, or that they print in their books, or that they talk about, no longer holds. They want a very much larger price for their battery, or their guarantee will be very much less favorable. And I admit that it is perfectly proper that they shall protect themselves; that that battery shall be used under certain conditions and in certain ways. They cannot guarantee a battery or a steam engine or anything else that is improperly used. But what I maintain is that it is not econom

ical under most conditions of central station practice, or at least where the demand is somewhat excessive in the way of discharge, to use the storage battery; that their prices are put up so high in order to give them a safe guarantee. Now there was a paper read at the Philadelphia meeting of the Institute, by Mr. Griscom, in which he stated that if you make your storage batteries large enough, the depreciation may be reduced to practically nothing. That we all know. So if you do make your storage batteries large enough, the company are perfectly safe in making you a guarantee of 3 per cent., or 2 per cent., or 1 per cent., if they choose; but to take care of it. In Mr. Edgar's case, his lights were kept up to the proper voltage. He had the maximum load of his station thrown on without five minutes' notice. In three-quarters of an hour the cloud scattered, the sun came out, and the lights were turned off. Those who had used the Edison light in that case were highly satisfied, and those who had the alternating current light were complaining that it was from 20 to 25 minutes before they were able to see or read by their electric lights. Gentlemen, this seems to me of itself an exceedingly valuable use of the battery for the central station. If installed for no other purpose, it gives to



WATER-DRIVEN PUMPING AND ELECTRIC LIGHT PLANT.

your investment charges are very much larger under those conditions.

E. T. BIRDSALL: In regard to Mr. Perry's figures on the transmission of gas, he omits several important factors in the transmission of gas for that distance. In New York the subways are ventilated by pumping air through pipes, and they find that the loss of pressure per mile of eight-inch pipe, when delivering 12,000 cubic feet per hour, is 11 ounces per square inch. That is, starting with 16 ounces pressure, at the end of one mile the pressure is reduced to two ounces. That means, considerable power is used to pump that gas along, and that should be counted in the cost of transmission. Another factor is that the friction in the flow of gas in pipes depends greatly on the number of bends in the pipe; if it had a large number of bends or elbows, it would make a vast difference.

A third factor is the leakage factor. Every gas company in New York, except possibly the latest one, which has new mains, figured that the loss of leakage at the joints is about 10 per cent., and in that the loss of pressure in the electrical conductors is balanced at once.

In regard to the reason why batteries are not used more universally, it has always been my opinion, as the result of considerable experience, that all the first plants were too small for the work they had to do, and I will give two or three examples. One was a large private plant. A battery was put in, and it lasted six months under the use, and they put in a second one, about one-fourth larger, and that lasted about a year. The next one was about four times the size—that was about the time that I appeared on the scene—and that one lasted about three years, and now we are contemplating putting in one about eight times the size to do the work. In that connection, I might say that I just let a contract to-day to replace one of the plants that Mr. Leonard mentioned. This is due to no fault of Mr. Leonard's. I laid out the original plant—he merely installed it. The original plant was 300 ampere-hours' capacity, and the plant that takes its place is 800 ampere-hours' capacity. That is as big as I could get the man to buy. If I had my way it would have been about 1,600 ampere-hours. Though that is an unusual case. They have electric heaters, and that I think explains the whole matter. But this has been the great difficulty; a man would put in a battery, and as a rule it would be about one-tenth of the size necessary to the work, and the battery would fail in six months, and all batteries were the same in his eyes after that. In regard to guarantees, it is my present practice not to call on the companies for guarantees where I am reasonably certain of having a chance to look after the plant once in a while. The only experience I had with guarantees was not successful—the company failed before we had a chance to call on them.

A. E. CHILDS: Mr. Edgar in his remarks spoke of the value of his battery in cases of rapid changes of weather. I was in Boston one day in September, and I happened to be in an office taking light both from his company and from the alternating current company in that city. At three o'clock a very black cloud passed over the city, and inside of five minutes possibly every light in Boston that was ordinarily in use was turned on, and there is no doubt that inside of five minutes Mr. Edgar's station had on its maximum load. His lights were absolutely perfect; there was no diminution in voltage. The lights were steady without a single flicker. The lights in the adjoining office were low; they were like red-hot hair pins, and were flickering. The alternating current company's representative stated afterward that they had not even had time to fire up their boilers or to warm their engines before the load was upon them, and, so suddenly did it come, that it was impossible for them the company using such a battery an argument in favor of the storage battery that cannot be gainsaid.

## BOOK TABLE.

MODERN EXAMINATIONS OF STEAM ENGINEERS; OR, PRACTICAL THEORY EXPLAINED AND ILLUSTRATED. By W. H. Wakeman. Bridgeport, Conn.: American Industrial Publishing Company. 1895. Price, $2.00.

This is a practical, useful book of 272 pages, which is of larger scope than that indicated by the rather awkward title. Starting out with the assumption that there are many men in charge of steam engines, or employed about engine and boiler rooms, who are not possessed of sufficient technical and theoretical knowledge to pass successfully an examination of ordinary thoroughness to obtain a license from United States or local authorities, the author gives a large amount of practical, elementary information intended for all who aspire to become comp tent engineers. The book is plainly written and adapted to the comprehension of all, but it is really more than a mere "coach" to workmen desiring to take out licenses. It is a good book for every steam engineer to have; it should stimulate a desire for a more exact knowledge of the beautiful principles underlying the use of steam. The men in charge of our stationary engines can hardly be too well informed on the best methods of practice, and even the most confirmed user of the "rule of thumb" must admit that Mr. Wakeman is right in saying that "theory will do practice no harm." The book goes down to first principles, and tells the ambitious, untrained engineer how to extract the square root of a given sum, how to compute the horse power of an engine, how to set valves, how to determine the proper length of an eccentric rod, and so on. It is supplied with 300 test questions and an index, and is recommended as a good, practical book for steam engineers desiring a hand-book of elementary information.

The Textile Manufacturers' association of the South and West has issued a call for a conference of all textile manufacturers of the West and South to meet at the Palmer House, Chicago, January 14th, to consider financial conditions. C. S. Tomlinson, 177 Adams street, Chicago, is the secretary of the association.

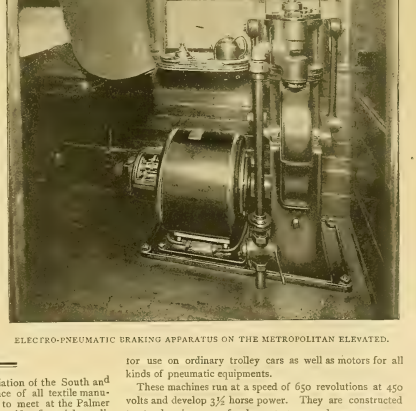
## Water-driven Pumping and Electric Light Plant.

The illustration represents a pumping plant in the city of Spokane, Wash. It consists of five 54-inch New American turbines, four of which furnish power for four duplex Holly pumps, each of 3,000,000 gallons capacity per 24 hours. This plant is located on the Spokane river, about three miles from the business center of the city. The water is forced through about three miles of pipe to a reservoir elevated about 300 feet above the business portion of the city. The turbines work under a 14 feet head, each wheel developing 195 effective horse power. The power of the fifth wheel will be utilized for electric lighting. The turbines are placed in substantial iron flumes, the whole mounted on solid masonry and steel I-beams. The harness which supports the driving machinery is of the same construction, with iron bridge-trees. The driving gears are wood and iron machine-dressed teeth. The pumps are anchored directly on the stone foundation. The water is supplied to the turbines by one feed pipe, connected with the flumes in which the turbines are placed with branch pipes. The branch pipes are supplied with gate valves, so that the water can be shut off from the water wheels when occasion may require. The entire outfit, being stone and iron, will be very durable.

This attractive plant was designed and furnished by the Dayton Globe Iron Works company of Dayton, O.

## Electro-pneumatic Braking Apparatus on the Metropolitan Elevated.

The public is quick to appreciate the advantages of an electrical equipment on an elevated railroad, such as the Metropolitan of Chicago. The absence of smoke and cinders from puffing locomotives, and the smooth, easy running are patent to all. The braking system is not so well understood, but it is, of course, of the highest importance. The equipment in use presents several features of interest. Compressed air is used, and the compressors, which were furnished by the New York Air Brake company, are placed in the cab set apart for the use of the motorman. These compressors are operated by motors directly connected, and, as will be seen by the accompanying illustration, the equipment is very compact. The motors are completely enclosed, dust and moisture-proof, and were furnished by the Storey Motor & Tool company of Philadelphia, which also supplies equipments of a similar kind for lighter work and



ELECTRO-PNEUMATIC BRAKING APPARATUS ON THE METROPOLITAN ELEVATED.

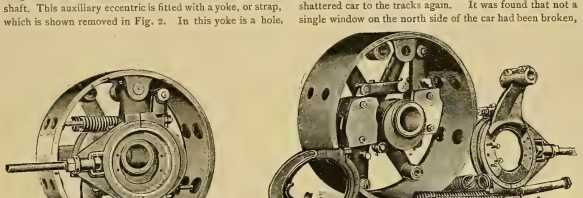
for use on ordinary trolley cars as well as motors for all kinds of pneumatic equipments.

These machines run at a speed of 650 revolutions at 450 volts and develop 3½ horse power. They are constructed to stand an increase of voltage to 700, and occupy a space over all of 15⅝ by 30½ inches. They weigh 400 pounds, and there are at present 61 of them in operation.

## Brownell Automatic Governor.

The accompanying cuts show the governor used by the Brownell & Co. of Dayton, Ohio, on its automatic engines. In the illustrations Fig. 1 is a view of the complete governor, while Fig. 2 shows the main eccentric, the auxiliary eccentric yoke and the springs removed.

As will be seen, the governor has the usual arrangement of weights and springs, and belongs to that class of governors in which the eccentric swings from a fixed point. The principal feature of the governor is the manner in which the motion of the weights is transmitted to the main eccentric. As is shown in Fig. 2, the weights are connected by links to the ears of the auxiliary eccentric, which is fitted to turn upon the hub of the governor wheel, so that as the weights are moved the auxiliary eccentric is turned around the shaft. This auxiliary eccentric is fitted with a yoke, or strap, which is shown removed in Fig. 2. In this yoke is a hole,



FIGS. 1 AND 2. BROWNELL AUTOMATIC GOVERNOR.

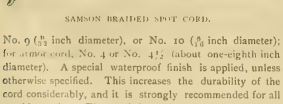
which receives the pin bolted to the main eccentric. Thus, as the auxiliary eccentric is turned around the shaft, its yoke is thrown across, carrying with it the main eccentric, which is thus moved nearer to or farther from the center, thereby decreasing or increasing its throw.

The advantages of this combination of eccentrics are that the governor is mechanically locked in every position it assumes, and can only be moved by pulling on the weights, the pull of the valve having no effect whatever, while at the same time, the governor is free and certain to act, sensitive, strong and durable.

To reverse the governor, the pin bolted to the main eccentric is changed to the holes on the opposite side; the weights and springs are changed to the holes provided for them, and the operation is complete. Engineers will appreciate the simplicity of this operation. The governor is compact, yet all adjustable parts are very accessible. All wearing parts are circular in form, thus insuring smooth, uniform wear. The entire wear of the governor is taken up by two simple adjustments. The governor was designed and patented by H. C. Clay, superintendent of the engineering department of the Brownell & Co., Dayton, O.

## Samson Braided Cord.

Samson braided cord has now become recognized as a standard device for the suspension of arc lamps, and it is no less in demand for trolley cord and armor cord for covering magnets of dynamos. The size in greatest demand for hanging arc lamps is No 12 (three-eighths inch diameter); for trolley cord, No. 8 (one-fourth inch diameter),



SAMSON BRAIDED SPOT CORD.

No. 9 ($\frac{5}{16}$ inch diameter), or No. 10 ($\frac{3}{8}$ inch diameter); for armor cord, No. 4 or No. 4½ (about one-eighth inch diameter). A special waterproof finish is applied, unless otherwise specified. This increases the durability of the cord considerably, and it is strongly recommended for all outside service. The cord is made of cotton, linen or Italian hemp. The cotton cord is, however, more commonly used, and is probably quite as durable as either of the others. In order to protect their customers against the substitution of low grade cord, the Samson Cordage Works of Boston, Mass., have undertaken to provide a distinctive mark which will at all times be indicative of first quality cord. They now furnish, therefore, the Samson spot cord, which is the regular Samson cord marked with a series of colored spots. This device has been adopted as a trade-mark, and the cord is, as heretofore, warranted of pure stock, perfect braid and smooth finish.

## Curious Accident on the Metropolitan "L."

A motor car on the Metropolitan West Side elevated road in Chicago plunged through the terminal bumpers at the West Forty-eighth street station on the morning of December 23d and fell into the street below. The rear end of the car caught on the elevated structure, so that it almost stood on its head in the street. The car was on the north track and struck the heavy oak bumpers at full speed. The big iron bolts which fasten the beams to the structure were torn from the wood; the beams gave way and the car plunged into the street. It met some trolley wires above the street and hung for a moment. Then its great weight broke through the wires and carried them down. With daylight came the officials of the road and gangs of men to hoist the shattered car to the tracks again. It was found that not a single window on the north side of the car had been broken, and the car had stood the strain well, except that the floor was damaged and both trucks knocked off. The accident did not prevent the running of the trains as usual. No one was seriously hurt. It is reported that the accident was due to the motorman sleeping at his post.

## The Philadelphia Strike.

The strike of the conductors and motormen of the Union Traction company appears to be over at last. After returning to work once, the men had several misunderstandings with the officers of the company in relation to wages and the retention of non-union men. At the last account, however, the men were at work, awaiting developments under a temporary agreement.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, December 28.—Mayor Schieren is in favor of a trolley system on the Brooklyn bridge, believing that the lighter cars can be handle so that a greater number of passengers can be carried than by the cable system. Recently the Nassau Electric Railroad people made an informal application, it is said, to the bridge trustees for the privilege of running trolley cars across the bridge without change of cars and without an extra fare. When Mayor Schieren was asked his opinion of the feasibility of the project, he said he was convinced that it was feasible, and that the idea was an excellent one. "As one of the trustees, I have given a good deal of thought to the subject of carrying passengers over the bridge by trolley-cars," said the mayor. "I believe a loop system could be devised by which this could be accomplished. I have consulted the engineer about it, and, while we did not go into the subject as deeply as we might, he has not said it could not be done, nor has he pronounced in favor of it." Mayor Schieren said that the loss in revenue on account of carrying the people across free could be made up by charging the trolley company a half-cent or a cent a head. "The revenue derived at present is about a million and a half a year," said the mayor, "but the expenses are over a million, and there remains only about $450,000 net income." Relative to a 4-cent fare, the Mayor said: "I have no doubt the trolley companies could give the people a 4-cent fare if they didn't water their stock so much."

Another Brooklyn bridge scheme of interest contemplates telephonic communication between the train dispatcher and every car in motion. Experiments to this end have been made under the direction of Kingsley L. Martin, assistant engineer of the bridge, and they have proved entirely successful. Under the proposed system metallic circuits will be used. The dispatcher will sit in his office wearing a head-telephone and a long-distance transmitter will be at his desk. At the front and end of each train in service a telephone will be placed. In foggy weather the gripmen will wear a telephone receiver as a headpiece, so that they can respond instantly if called up by the despatcher. Mr. Martin believes that such a system of telephoning would be a guarantee against accidents on the bridge railway.

President Rossiter of the Brooklyn Heights Railroad company says that early in 1896 some of the Brooklyn face roads will begin extended operations, improving their service. He says his company is ready to spend a large amount of money to improve its system, and work will be begun at several points in the spring. The new station in the Eastern District will be completed by February 1st. In it will be a reading-room for conductors and motormen, and there will be bath tubs and shower baths. A large brick repair shop is to be built in South Brooklyn. The company, Mr. Rossiter says, has bought over 4,000 tons of new 90-pound steel rails, to be delivered during the winter months, and will provide for the reconstruction of part of the road-bed. There will be extensions and improvements, and the company expects to adjust the matter of the extra 5-cent fare now charged on some of the suburban lines.

From West Virginia, the charter home of the Long Island Traction company, comes the news that the sale of the company has been confirmed. The dispatch is dated at Clarksburg, December 26th, and reads as follows: "Two important cases came to an end to-day. Both were heard by United States Judge Goff in chambers. The case of William M. Kidder and others against the Long Island Traction company and the New York Guaranty & Indemnity company against the Long Island Traction company and others were consolidated, and upon the hearing a settlement was reached by which $5,500,000 will be paid by the purchaser of the Long Island Traction company property and at once distributed. There were present to-day J. G. Jenkins, L. S. Williams and C. A. Vollin, attorneys of Brooklyn; Julian T. Davis, Harris D. Colt, Arthur W. Butler and W. C. Trull of New York; G. E. P. Howard, the private secretary of ex-Governor Flower; Horace G. Morse, receiver, and Kingsbury Curtis, special master."

The International Bell Telephone company has declared a dividend of 6 per cent., payable January 3d.

W. F. O.

## Northwestern Notations.

MINNEAPOLIS, December 27.—It is said that there are several miles of unused subways in St. Paul, the property of the National Subway Company. It has been stated that they revert to the city owing to the company not paying its taxes. The Board of Public Works is investigating the matter to ascertain the right of the city to use them, and also the poles of electric companies.

The Watertown, S. D. electric light company will shut down its plant.

The Postal Telegraph Company is negotiating with Mankato, Minn., with a few to extending its line from Randolph, Minn., about ninety miles.

The Edison Power and Light Company, of La Crosse, Wis., has recently put in a 2,000 light monocyclic electric dynamo furnished by the General Electric Company.

The Kenosha Light and Power Company, of Kenosha, Wis., has incorporated with $12,000 capital stock. W. W. Stroug, S. C. Newman and G. R. McDonald as the incorporators.

The electric light plant put in by the Montevideo Mill Company, of Montevedeo, Minn., will soon be in operation.

The McCook Electric Light Company has been negotiating for the purchase of the electric light plant at Hastings, Neb.

A citizens' committee at Beatrice, Neb., reports that an electric light plant in connection with the water works can be put in at a cost of $9,000 for a 50-arc light plant and for $6,000 additional for a 1,200 16 candle power incandescent plant.

The electric light plant at Beresford, S. D., has been closed on a mortgage foreclosure.

It is said that Jamestown, N. D., will dispense with electric lights soon as a matter of economy.

The City Council of Council Bluffs, Ia., has been disputing with the Council Bluffs Gas & Electric Light Company for several months over the number of lights out during the month and about the amount to deduct from the monthly bills. The council committee quietly went to work and made tests as to the voltage and had an electrical engineer from Omaha make tests, which showed that the city was not getting what it was paying for. The company hedged when the report was read to the council and promised to improve matters.

The city of Yankton, S. D., has received a proposition from the electric light company to furnish the city forty street lights for the same price that seventeen are now being furnished. A misunderstanding last April caused the electric company to cut out the city hall, and it has been lighted with kerosene since that time. These lights are to be restored also.

A resolution has been prepared and will soon be offered

to the West Superior, Wis., city council to annul the franchise of the Superior Rapid Transit Railway Company. The resolution states that it has forfeited the franchise in several particulars, one being that it failed to heat the cars in October and November, that it did not keep the space between the tracks in repair, and that the cars are not run on schedule time.

C. E. Loss & Co. have applied for a receiver for the Central Wisconsin Electric Street Railway company of Oshkosh, Wis., and allege fraud in a number of particulars. The claim is made that 20 per cent. of the capital stock subscribed has not been paid in, as required by the state law, and other violations of the law are asserted. This company has recently secured a further extension of its franchise in Oshkosh, to next June, despite the application for a receiver. M.

## PERSONAL.

Prof. William Esty, assistant professor of electrical engineering in the University of Illinois, was in Chicago on Monday.

It is reported that when Gov. Frank Brown retires as chief executive of Maryland he will devote his time to the affairs of the Baltimore Traction company, of which he is president, and on May 1st next he will sail for Europe on an extended tour.

## TRADE NEWS.

A finely illustrated "write-up" of the American Electrical Works of Phillipsdale, R. I., is contained in the special edition of the Providence *Evening Telegram* of December 21st.

P. C. Ackerman, New York agent of the American Electrical Works, expresses great confidence in the outlook for future business in the electrical trade, on the basis of future orders which he has secured for his company of late. This, coming from a gentleman thoroughly in touch with the business, is a gratifying evidence of improving conditions.

The Electric Appliance company reports that its sales of the Packard transformers exceed even its greatest expectations, and claims that after handling this apparatus for three years, it has yet to receive the first one to be returned as burned out by lightning. The company carries a complete line at Chicago, and can ship any orders promptly from stock.

The Joseph Dixon Crucible company of Jersey City, N. J., is as enterprising as it is reliable. It has a well-known standard product and knows how to exploit it in an attractive, taking manner. Its recent booklet, "Hints of What We Manufacture in Graphite," is well arranged and will be widely read. Electricians will be especially interested in the pages devoted to lubricating graphite and graphite for electrical use.

E. H. Forst, general manager of the California Supply & Construction company of San Francisco, Cal., has been in New York during the past two weeks arranging for a large amount of electrical apparatus to be installed in the Parrott building of San Francisco, which is expected to be one of the largest buildings west of Chicago and second in size to the Palace Hotel of that city. The electrical installation will include 4,000 incandescent lamps, 550 arc lamps and 15 Sprague electric elevators, while Interior Conduit will be used throughout the building. Mr. Forst will go direct from New York to San Francisco on his return.

The Ohio Storage Battery company of 52 Wade building, Cleveland, O., is exploiting the Ford-Washburn Storelectro company's batteries. The company points to the entire absence of plates in its cell as a great advantage and adds: "The construction of our cell obviates the necessity of ruinous repairs; in other words, it stands incessant charge and discharge with so little perceptible wear, that it compares with a well built dynamo and motor as to absence of repairs and in requiring no attention. Not only will our battery stand repeated discharges on dead short-circuit without injury, but it will remain in first-class condition for an indefinite period of time, when unused, on an open circuit."

The Metropolitan Electric company of Chicago closes a prosperous year with bright prospects for still greater business success in 1896. In addition to N. I. R. wire, P. & B. insulating compounds, Storey motors, Metropolitan incandescent lamps, and the other old and well-known specialties which it handles, the company has recently added to its list the switches of J. Grant High & Co. and the American Carbon company's goods, both very favorably known. The Metropolitan people have also had a remarkable holiday run on a toy $1 motor, which seems to have captured the heart of Young America, and report many sales of interior iron pipe wiring conduit. The clear business sagacity of President W. H. McKinlock is largely to be credited with the present magnitude of the company's business, well shown by the mammoth catalogue recently issued.

Employes of the Viaduct Manufacturing company had a jollification and flag-raising recently at the company's works, situated at the Baltimore & Ohio railroad's viaduct over the Patapsco river, seven miles from Baltimore. The jollification was over the occupation of the new works, the old buildings having been destroyed by fire last June. A straight, white 75 foot pole has been set up between the machine shop and the stock room of the plant. It is surmounted by a 10 inch gilt ball, and from it was flown a 20 foot flag. The reconstructed works, which were occcupied in November, are on a larger scale than the plant which was burned. Every department is on the ground floor. The principal buildings cover spaces of 100 by 40, 200 by 48 and 68 by 48 feet, respectively. In addition there are a dry-house, forge and office building, all of brick, and also lumber sheds. The company owns 25 acres of land along the river front. All the buildings are filled with the most approved machinery for manufacturing small electrical goods. Telephone apparatus, including magneto bells and district messenger boxes, are the principal articles made. About 100 persons are employed at the works.

Apropos of the talk about the great Ferranti alternator of London, lately installed, it will be gratifying to Americans to learn that an American insulating material was incorporated in this interesting product of British electrical engineering. In this machine the armature weighs 35 tons. The insulation between the carrier and the coils is effected with micanite shields. The carriers consist of two heavy brass castings clamped on to the segments. The complete carrier is supported on two bolts projecting from the rim. The insulation of these bolts is a matter of great importance. The field coils on the new Ferranti alternator are constructed by winding bare copper strips on edge into a spiral, with insulation between adjacent turns. The danger of the high voltage from the bare copper of the armature sparking across to the field has been overcome in this case by placing micanite caps over the poles. These caps, which are about one-eighth inch thick, have all been tested up to 25,000 volts. Since being in use no faults have developed in them. The micanite used in the construction of this machine was manufactured in the American factory of the Mica Insulator company at Schenectady, N. Y. This company has recently established a factory in London, England, where it now manufactures micanite in its various forms.

In an October issue of the WESTERN ELECTRICIAN mention was made of the fact that General Manager Herbert H. Brooks, of the American Circular Loom company of Chelsea, Mass., had organized a western department for his company and obtained a handsome suite of offices at 1114 Marquette building, Chicago, placing the management of the western business in the hands of A. D. Chandler. Following the plan decided upon at that time, Mr. Brooks has remained in the West, and, together with Mr. Chandler, has pushed a most energetic campaign in the interest of the American Circular Loom company. It was a foregone conclusion to the friends of Messrs. Brooks and Chandler that their appearance in the west under such circumstances was a wise move. Although it had not been Mr. Brooks' intention to remain permanently in the West, still the western department has been so remarkably successful that it is a question as to how long Mr. Brooks will continue to act in conjunction with Mr. Chandler. The business thus far accomplished by these energetic men is such as would indicate a great amount of forethought in the company's enterprising move. Mr. Brooks' large acquaintance among the supply people and other buyers no doubt has aided them greatly in making such an excellent showing. In fact both Messrs. Brooks and Chandler have acquitted themselves in a manner that leaves no doubt that they will receive the American Circular Loom company's happiest greetings for a continuance of the already happy New Year.

The Gordon-Burnham Battery company of New York, although only three months in business, has a record of which it can be justly proud. The primary battery which this company sells has a very high efficiency, said to be four times greater, weight for weight, than the ordinary gravity cell. The explanation offered is, that the elements of this battery cell are in such shape that a much larger surface is exposed than in any other battery, and in consequence the electrolytic action is greater. The company offers to furnish a written guarantee that this cell will not freeze at zero temperature, as a solution of saturated alkali is used. The cell is manufactured in two sizes, will not leak, and does not require an expert to prepare or handle it. General Sales Agent Ralph W. Gordon has recently returned to New York after an extended trip through the central and western states, and as a result of his trip and the tests that have been made with the battery, a number of the leading railroad companies have adopted it exclusively, among them being Pennsylvania lines from New York to Chicago the Illinois Central Railroad, Chicago & Northwestern, Chicago, Burlington & Quincy, and the Northern Pacific. On account of other numerous inquiries and duplicate orders to be placed, Mr. Gordon will be compelled to make a return trip in January. General Manager F. A. Burnham attends to the general detail, which has grown to large proportions of late, and he reports that the company has now under consideration the extension of its manufacturing facilities. There are but few better known electricians than Geo. A. Johnson, who has charge of the technical part of the Gordon-Burnham Battery company. His long experience in telegraph, railway, and signal work has fitted him to take charge of the construction department of this company. He has for an assistant W. C. Banks.

## BUSINESS.

The Kester Electric Manufacturing company of Buffalo manufactures the Niagara telegraph outfit for learners and students. This is said not to be a toy, but an instrument of real, practical value.

It is generally supposed that the demand for weatherproof wire is limited after December 1st, but the Electric Appliance company reports that its sales are increasing, and, if anything, are larger than during the fall months.

The Boudreaux Dynamo Brush company looks over the campaign of the last year with great satisfaction. Its foliated anti-friction metal brush has been received with the same favor which it met at its first appearance in Europe four years ago. The company has just brought out a handsome sample device for the leading supply houses. It consists of a shield covered with crimson plush, upon which different sized brushes, from a small fan motor brush to those for large multipolar generators, are artistically arranged. It makes a very rich and ornamental display.

The Western Telephone Construction company, Chicago, reports that it has recently equipped with telephones and switchboards exchanges at Sistersville, W. Va.; Charleston, W. Va.; Sulphur Springs, Tex.; Port Gibson, Miss.; Kalamazoo, Mich.

A carbon for use in arc lights, it is well understood, must be made in the most careful manner, by those who are thoroughly conversant with the art, in order to stand the tests of efficiency; and from the long list of letters praising the "Electra" carbons in the possession of Hugo Reisinger of New York, who is the sole importer, it is evident that the carbon named fills all requirements of excellence.

The Perkins Electric Switch Manufacturing company is well known to the electrical trade, East and West, and probably much of its popularity is due to that pushing salesman, C. I. Hills, who has charge of the New York office and general sales between New York and Chicago. He is now arranging for an extended trip to the West in January, and has a number of novelties which will cause the purchasing agents of more than one supply house and central station manager to await his arrival.

The Stillwell-Bierce & Smith-Vaile company has installed a waterworks pumping plant at Alexandria, Ind., that is highly praised. The station is fitted with two duplicate pumping engines, each having a capacity of 2,000,000 gallons each 24 hours; they are of the compound, noncondensing, duplex pattern. The *Gas Belt News* says: "No question exists but that Alexandria's citizens and officials feel perfectly confident that the Smith-Vaile machinery in the pumping station is equal to any in the state; all are apparently enthusiastic in its praise, and not one word has yet been spoken against it."

For the 28th time "Kerite" rings its glad tidings for a happy New Year, and this time, as many times before, comes the kindly greeting to the trade from the man whose energy and magnetic personality have brought such remarkable results for Kerite in the western field. Not many salesmen are there in any line of business that can boast of friendship alike with buyers and their own strongest competitors, but it must be said to the credit of S. F. B. Morse that there were this season few among the "boys" that received heartier or more kindly greetings and best wishes for a happy New Year.

It is a pleasure to announce that in completing the year, the Eddy Electric Manufacturing company of Windsor, Conn., reports that its business will aggregate over double that taken in 1894, with a large amount of prospective work on hand. This concern owes its success largely to careful management under the direction of Secretary A. D. Newton and General Manager M. E. Baird, and the same success is predicted for the future. Recent orders for Eddy machines have been received from the following: Stanley Works, New Britain, Conn.; Eldredge building, Boston; Hartford Rubber Works company, Hartford, Conn.; Hartford Cycle company, Hartford, Conn.; Fraser & Chalmers, Baker City, Ore.; Central Coal & Coke company, Texarkana, Ark.; Chambers Electric Light & Power company, Truro, Nova Scotia; Lowell Electric Light corporation, Lowell, Mass.; *New York Herald*, New York; Hammerstein's Olympia Theater, New York; Burlington Woolen company, Winooski, Vt.; Culver Military Academy, Marmont, Ind.; M. T. Davis & Co., Montgomery, W. Va.; Maine State College, Orono, Me.

When one looks over the list of recent business which has been secured by the western department alone of the Safety Insulated Wire & Cable company, one will be inclined to believe that the New Year, for this company at least, will be a decidedly happy one. A recent visitor at the office of Leonard F. Requa, general manager of this company, in the home office in New York, was astonished at the account of the company's recent remarkable record. This company has been installing over 60 miles of underground feeders for the West Chicago Street Railway company, and also the underground feeders for the Pabst Power company, Milwaukee, Wis.; the underground feeders for the Edison Illuminating company of Milwaukee, and underground feeders for the Chicago City Railway company. It is interesting to note that among the more than 900 splices in the cables for the West Chicago Street Railway company not one was found to be imperfect, and this would substantiate the statement made by this company that it has the best cable corps in the country. This branch of the work is under the direct supervision of Lieut. E. J. Spencer of St. Louis, Mo. The Safety Insulated Wire & Cable company is also making a specialty of underground work and is doing all its own construction when possible, and is thus able to give the very strongest of guarantees. The well-known Requa White Core and Safety wire is in great demand, and keeps M. B. Austin, the Chicago agent of this company, very busy in attending the calls upon his time in the western territory. Among the numerous orders recently taken was a contract for wire in the new Concord building, Chicago. Mr. Requa reports that the factory has been running nights for the past six months in order to keep abreast of the orders. It is a matter of congratulation to Lieut. Spencer and Mr. Austin that they have handled their departments with such success during the past year, and reflects credit upon them as well as the company they represent.

Secretary and Treasurer Thos. I. Stacey of the Electric Appliance company, Chicago, recently returned from an extensive trip throughout the southern and southeastern states, and was interviewed by a representative of the WESTERN ELECTRICIAN. Mr. Stacey said: "Yes; I combined business with pleasure in my recent trip through the South. I was struck with the showing of the rapidly increasing prosperity that the South now presents. Making, as I did, quite a large number of towns and talking

with so many southern people, I reached the conclusion that the southern field was a good one for electrical business. Of course, as is well known, the southerner's prosperity is gauged largely by the cotton crop, and this year, although the crop was small, the cotton planter had profited by previous experience and greatly lessened the cost of production: hence, even with the small crop, through the better price and the cheapening of production, the southerner is left this year with more money. On the whole, I am glad to have made such an extensive trip and such an encouraging one. I should state, however, that a portion of Florida is feeling decidedly 'blue.' Blasted orange crops are the cause of many orange planters having entirely lost heart, and they are making no effort to try it again; but Florida is the exception."

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued December 24, 1895.*

551,755. Switch Operating Mechanism. John P. Coleman, Swissvale, Pa. Application filed February 21, 1895.

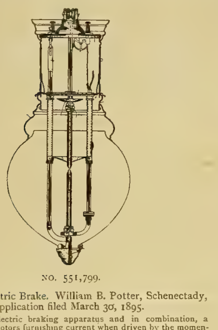
The combination of a fluid pressure switch operating mechanism, having magnets controlling the normal and reverse valves and magnet controlling a lock for the valves. make-and-break mechanisms in the circuits of the magnets, electrically controlled latches controlling the make-and-break mechanisms in accordance with the positions of the switch rails, the circuits of the magnets operating the latches being formed in part by the circuit of the magnet controlling the lock of the switch operating mechanisms.

551,757. Electrically Operated Elevator. Fred B. Corey, Boston, Mass. Application filed May 13, 1895.

In an electric hoisting mechanism, the combination with a shunt wound motor, of an electro-magnetic switch for controlling the armature current of the motor, two solenoids in multiple arrangement for actuating the switch, a plurality of double push-buttons or contact switches in multiple arrangement adapted to close either solenoid circuit, the electro-magnetic switch being arranged to open when the push-buttons are released, and a system of connecting circuits.

551,781. System of Electrical Distribution. Thomas F. Mullaney, Worcester, Mass. Application filed September 24, 1895.

In a system of distribution, the combination of conductors divided into sections, the adjacent sections being of opposite polarity, with switches for connecting certain of the conductors in such a manner that they may be supplied with current of the same polarity.



NO. 551,799.

551,785. Electric Brake. William B. Potter, Schenectady, N. Y. Application filed March 30, 1895.

In an electric braking apparatus and in combination, a motor or motors furnishing current when driven by the momentum of a moving vehicle, a local circuit for such motors, brake magnets in the local circuit, a controller and a resistance also in the local circuit, contacts and cross-connections upon the controller adapted to vary the amount of resistance in circuit or to open the circuit, and auxiliary contacts and cross-connections arranged to cut out the brake magnets and resistance and to short-circuit the motor upon itself at a certain definite position of the braking controller.

551,786. Lightning Arrester. William B. Potter, Schenectady, N. Y. Application filed August 31, 1895.

A lightning arrester comprising a number of spark-gaps in series, each spark-gap inclosed in a chute, and a common magnetic blow-out for all of the gaps.

551,790. Machine for Connecting Electric Conductors. Harlie J. Savory, Somerville, Mass. Application filed April 17, 1893.

This is a device for connecting a small electric conductor to a larger one. It has a frame provided with a clamping device to clamp it upon the larger conductor, and a clamping device to clamp the small conductor to the frame, combined with a hand-set to upset the small conductor within a perforation within the larger

551,795. Electro-galvanic Belt. Samuel J. Spalding, Canton, O. Application filed May 9, 1895.

In an electro-galvanic belt the combination of a sheath, having connected thereto a series of cells by means of an elastic [illegible], a reversible link, one end thereof provided with [illegible] material, and a number of electrodes secured to the [illegible] and a hook.

551,799. Electric Arc Lamp. Elihu Thomson and Charles [illegible] Harthan, Swampscott, Mass. Application filed [illegible] 1895.

[illegible] reads: In an electric arc lamp, the combination [illegible] supporting the globe-holder, a hook connecting [illegible] part of the lamp, a plunger for releasing [illegible] for allowing the operation of the plunger [illegible] in a predetermined position.

551,[illegible]. [illegible] Single Into Polyphase Alternating [illegible] Charles S. Bradley, Avon, N. Y. Application filed June 11, 1892.

[illegible] difference of alternating currents [illegible] two electromotive forces differing [illegible] and inductively co-operating [illegible] connected with respect [illegible]

551,810. Alternating Current Motor. Charles S. Bradley, Avon, N. Y. Application filed September 12, 1893.

An alternating current induction motor comprising a fixed primary element and a movable secondary element carrying a switch, and two or more series of contacts for grouping the secondary windings to vary the number of effective turns on the secondary winding.

551,820. Mechanism for Operating Elevator Controlling Mechanism. Frank E. Herdman, Winnetka, Ill. Application filed July 10, 1895.

The second claim is given: The combination with a driving motor and controlling mechanism for the same, of an electric motor, connection between the electric motor and the controlling mechanism of the driving motor, a switch device for admitting current to the motor, connection between the electric motor and the switch device, means independent of the electric motor to move the switch device, the extent of movement of the switch device by the electric motor being determined by the extent of the movement of switch device by means independent of the motor.

551,856. Commutator Brush. Caleb C. Dusenbury, Lake Mahopac, N. Y. Application filed June 10, 1895.

The combination with the commutator brushes, of an end frame, arms of metal permanently united therewith, sleeves of insulating material surrounding said arms, and upon which the brushes are mounted, and an adjustable device for applying pressure to the brushes.

551,863. Alternating Current Machine. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed May 1, 1895; patented in France June 11, 1892.

An apparatus for producing and maintaining synchronous rotation, comprising a synchronous alternating current motor of low resistance and self-induction, and having a constant field of force, and a synchronous alternating current motor of comparatively high self-induction, both simultaneously fed from the same alternating source and having their rotating elements mechanically coupled.

551,880. Electrical Eye Cup. Theodore B. Wilcox, Newark, N. J. Application filed January 10, 1895.

An eye cup for application to the eye, carrying adjacent metals of different character adapted to constitute battery elements.

551,920. Electric Stop Motion for Machines for Preparing Sliver. William P. Canning, Lowell, Mass. Application filed June 19, 1895.

This is an application of an electrically operated magnet to automatically stop the motion of a machine used in cotton factories.

551,930. Electric Railway Train Signaling. Walter S. Greene, Covington, Ky. Application filed September 3, 1895.

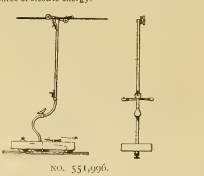
An electric railway train signal, comprising electric annunciators for the engine and cars between which communication is desired, circuit closers also for each of said engine and cars, a three-wire system of electrical conductors extending through the train, and an electric generator whose poles are connected respectively to two of the wires, the annunciators being connected up in multiple to one of the generator wires and the third wire, and the circuit closers being connected up in multiple to the other generator wire and the third wire, and the wires being formed in sections corresponding in number to the number of cars of the train and connected up in divided circuit with coupling devices.

551,942. Electric Latch Apparatus for Semi-automatic Operation of Railroad Signals. Harry C. Barnes and William W. Slater, Oakland, Cal. Application filed March 21, 1895.

This signaling apparatus comprises a movable signal or semaphore, a latch lever, stop, and intermediate mechanism, with a controlling electro-magnet and battery, a bell or annunciator whereby a "clear line" is indicated, binding posts with which wires from the battery are connected, a relay connected with the main line battery, an arm actuated by the armature of the relay to connect or cut off the current from the signal battery and magnet, an elastic arm which connects the binding posts through the electro-magnet when the latch mechanism is engaged, and which shunts the current through the annunciator mechanism when the latch is disengaged.

551,947. Electric Telegraph. William H. Cooley, Brockport, N. Y. Application filed March 23, 1889.

Of a large number of claims, the second is given: In a telegraphic circuit, a main line wire, an inductorium and a relay or other receiving instrument located in such main line circuit and at the same station, in combination with a balancing coil on such relay, a transmitting instrument and a distributer located together with the primary coil of such inductorium in circuit with a source of electric energy.



NO. 551,996.

551,948. Electric Telegraph. William H. Cooley, Brockport, N. Y. Application filed April 18, 1893.

A series of electric circuits or branch circuits, each containing a pair of relay contacts, means for causing a first impulse traversing such first circuit to open the contacts in such first circuit and close the contacts in the second circuit, and means for causing the second impulse, thus traversing such second circuit to open the contacts in the second circuit and close the contacts in the third circuit, and so on, the impulse thus traversing the last circuit in the series, causing the contacts in the last circuit to open and the contacts in the first circuit to close, whereby in each succession of impulses corresponding impulses are caused to traverse the same circuit or branch circuit

551,951. Automatic Temperature Regulating Apparatus. Charles L. Fortier, Milwaukee, Wis. Application filed May 8, 1893.

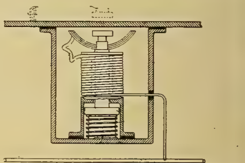
The combination with a heat controlling valve or damper, and means for operating the same, comprising an electric circuit, including an electro-magnet, thermostat and electric generator, of a motor arranged to operate said generator intermittently and automatically at frequent intervals, whereby current is produced only when needed and power is economized.

551,959. Thermostatic Regulating Device. Charles A. Hale, Cleveland, O. Application filed January 8, 1894; renewed February 18, 1895.

In a thermostatic regulating device, the combination of a clockwork for operating the temperature regulating devices and provided with a projecting lug upon its drive mechanism, a source of electricity, a thermostat in the circuit of said source, an electric alarm in another circuit connected to said source and normally open, an electro-magnet in the circuit of the thermostat and connected to be energized from the action of the latter, and having an armature provided with a stop adapted to stop and release the operating clockwork, and a spring switch having its free end in the path of the lug upon the drive mechanism and normally closing the circuit of the thermostat and electro-magnet, and closing the alarm circuit when engaged and moved by the lug upon the drive mechanism.

551,982. Station Potential Indicator. Ralph D. Mershon, Pittsburg, Pa. Application filed April 29, 1895.

A station potential indicator for alternating current systems comprising a local circuit in which the inductive and non inductive counter-electromotive forces and the impressed electromotive force of the main line are reproduced in miniature, and a voltmeter for indicating the value of the resultant of these electromotive forces.



NO. 552,001.

551,996. Pedo-electric Trolley. Robert T. Oney, Charleston, W. Va. Application filed March 27, 1895.

An individual trolley carriage comprising a platform, the carrier wheels beneath the same arranged in line with each other, a motor connected with one wheel, the trolley pole extending up from the platform, the seat and rheostat carried thereby, the brake for the rear wheel, the operating rod extending up through the platform to be operated by one foot of the passenger, the electric switch and the operating means therefor arranged to be operated by the foot of the passenger extending up through the platform of the car.

551,998. Electric Signal. Eugene M. Phelps and Archibald T. Sampson, Lynn, Mass. Application filed October 8, 1891.

In combination with the trolley wire of an electric railway signal, an electro-magnet in circuit therewith, a circuit closer controlled by an armature which is moved by a passing trolley, and arranged to keep the magnet energized, signals in circuit with the electro-magnet, and respectively located and arranged to show "safety" in a direction rearward from the point of operation of the actuating trolley, and to show "danger" in a direction ahead from the next turnout ahead, and a circuit breaker near said turnout.

552,001. Underground Current Supply for Electric Rail ways. August Rast, Nuremberg, Germany. Application filed March 29, 1894; patented in Germany October 24, 1893.

The combination with each feed section and its box, of a main conductor, a section-supply conductor, an electro-magnet in the box, with whose coil the conductor is connected, and a movable core in said magnet carrying a contact-piece connected with the coil to make contact with the feed section, whereby when the contact-piece on the core is brought into contact with the feed-section the main current will run through the contact-piece to the feed-section and strongly hold the said contact-piece in contact therewith.

552,036. Material for Incandescent Conductors. Ludwig K. Böhm, New York, N. Y. Application filed November 5, 1891.

A compound or substance for electrical conductors, consistsisting of a homogeneous mass of carbon and earth alkali metals forming a carbide.

552,053. Electrical Switch Operating and Signal Apparatus. Justin Dutrey, New Orleans, La. Application filed May 25, 1895.

The first claim reads: In an electric switch operating apparatus, the combination of the main track rails, turnout rails, a switch point or points, an armature lever fulcrumed at an intermediate point of its length, a connection between said armature lever and the switch point or points, an electro-magnet disposed so as to enable it when energized to draw one end of the armature lever in one direction, another electro magnet disposed so as to enable it when energized to draw the opposite end of the armature lever in the opposite direction, and a suitable means for energizing said electro-magnets.

552,057. Circuit Closer and Breaker. John R. Farmer, St. Louis, Mo. Application filed January 25, 1895.

In an electric circuit closer, the combination of a trolley wire, a contact plate placed parallel with the trolley wire, the circuit connecting said contact plate through an electro-magnet with a signal lamp and a suitable return connection, the armature having constant connection with the trolley wire under control of the electro-magnet, and adapted to close a circuit through the magnet, and suitable means for dropping the armature from a distant point.

Western Electrician.

EVERY SATURDAY.

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## The Home Life of Francis Blake.

A Boston newspaper man recently paid a visit to Keewaydin, the estate of Francis Blake at Weston, a Boston suburb, ten miles from town. Mr. Blake is the inventor of the telephone transmitter bearing his name, and is now leading a life of quiet enjoyment amid the elegant surroundings of wealth and leisure. In the course of an interesting chat with his journalistic visitor, Mr. Blake admitted that for two years he had done no serious work. "Since my invention of the long-distance transmitter," said he, "I have not invented anything of particular commercial value. Still, I am busy in here most of the time, for I take the keenest delight in machinery and all sorts of mechanical devices."

The inventor related his experiments in arboriculture, and confessed that coffee-roasting had formed a late diversion, which he had carried to the extent of erecting an $8,000 plant. Mr. Blake is also an amateur photographer. He has a gallery fitted up with all the necessary appliances for making pictures, his cameras being of exceptionally fine workmanship. The photographs from which the accompanying illustrations were made were taken by him, and his work has won several prizes in New York exhibitions. One of the finest pieces of his workmanship is a series of pictures of a galloping horse, showing the successive attitudes of the animal in motion. The manipulation of the camera was so exact that the dust thrown off the hoofs is caught and distinctly portrayed. Another remarkable picture of motion is that of a flock of flying pigeons, taken just as the birds were on the point of alighting on the ground. Still another was taken of an express train running at the rate of 40 miles an hour, every part of which was as clearly caught as if the train had been motionless. Next to his mechanical experiments and amateur photography, Mr. Blake is most interested in the improvement of Keewaydin, the name which he has given to his fine estate.

Laboratory, Boiler Room, Photograph Gallery and Stables. Residence and Sunken Garden.

THE HOME LIFE OF FRANCIS BLAKE.—VIEWS AT KEEWAYDIN, NEAR BOSTON.

Although Mr. Blake is very much in sympathy with all branches of scientific advancement, he could not be prevailed upon to prophesy much. In regard to what he proposed to accomplish himself, he was equally silent. "I think it is a great mistake," he said, "to talk about what you hope to do. Do it first, and then talk about it afterward."

"I don't see," he said, when questioned in regard to the future of sound transmission, "what more is to be attained in the short distance telephone. You may see evidence of this in the fact that men are no longer attempting to improve upon it as they were once. Perhaps you remember that for a few years after Mr. Bell's discovery there were an infinite number of improvements offered, but now electrical inventors have turned their energies into other channels which have not been so thoroughly worked. There must be some alluring promise to encourage men to study for the improvement of any piece of apparatus, and the telephone no longer holds any such inducement. As for the long distance telephone, there is practically no limit to the distance which may be covered on land. It is only the question of the size of the wire used."

"Do you think a transcontinental line is practical?"

"I doubt if it would pay at present. The plant would cost too much.

"Would you mind telling me how you chanced upon the discovery which bears your name?"

"Certainly not, although it would be quite a long story to go into details, for I was experimenting some two years or more before I was convinced that I had discovered the principles of a great invention. My attention was first directed to the Bell telephone in 1876, when Prof. J. E. Hilyard, a prominent member of the board which awarded Mr. Bell his prize for the telephone at the exhibition explained to me the instrument which he had examined. I was very much interested, for I had made a special study of electricity while I was attached to the astronomical service of the Coast Survey, where I was engaged principally in the telegraphic determinations of longitudes in various parts of the United States, Europe and South America.

"Very soon after this I constructed a pair of hand telephones myself, very much like Mr. Bell's, which I still have in my possession. I devoted a great deal of time—many months—to experiments designed to ascertain the best proportions for various parts of the telephone—the size of the coils, diaphragms, methods of clamping, etc. I constructed a microphone, after an article by Prof. Hughes, which appeared in *Nature*, I think. By experimenting upon the microphone I was finally able, after a great many trials, to construct one which, when placed in the circuit of my small hand-telephone produced most satisfactory results. I well remember that on the first test of this instrument every word was distinctly understood, while even a whisper was perfectly transmitted. I then became satisfied that I had the broad principle

of an important invention, and from that time on I devoted myself to a series of careful experiments to perfect the details and to discover the methods of adjustment of the parts necessary to produce the most nearly perfect results."

How well Mr. Blake did his work is evidenced in the remarkable fact that in 17 years the Blake transmitter has not been essentially changed in any of its parts. He gave it to the world already perfected.

Mr. Blake's life has been a remarkably varied and eventful one. In 1866 his uncle, George Smith Blake, secured his appointment from the Brookline High School to the United States Coast Survey, and it was while in this service that he began those scientific studies in which he has attained such eminent success. He was in the employment of the government for 12 years, and during that time his name was associated with important scientific achievements. His work met with the highest approval of his superiors, and his promotions were frequent. He was stationed for astronomical duty at Harvard, and also in Texas and Louisiana. While he was at Harvard he was interested in a very interesting experiment to determine the velocity of telegraphic time signals. A metallic circuit 7,000 miles long with 13 repeaters was used; and it was found that a signal sent from Cambridge to San Francisco was received back, after travelling 7,000 miles, in 8-10 of a second. He was also engaged as aid in a party organized for a hydrographic survey of the Susquehanna river near Havre de Grace, Md., and was engaged in similar service on the west coast of Florida and the north coast of Cuba. Mr. Blake did further astronomical and geodetic work for the government on the coast of New Jersey; was sent to Steubenville, Ky., to observe the total solar eclipse of August 7, 1869, and was ordered to determine the astronomical latitude and longitude of Cedar Falls, Iowa, and St. Louis, Mo. For a time he was detached from the Coast Survey and was appointed astronomer to the Darien exploring expedition, under the command of Commander Selfridge, U. S. N. This expedition was for the examination of the Aratro and Tuyra river routes for a ship canal across the isthmus of Darien. The zeal, ability and ingenuity which he displayed on this very hazardous expedition won for him high praise from the officres in charge, and he was recommended for promotion. Three years after this he was offered charge of the transit of Venus expedition to the southern hemisphere, but he was forced reluctantly to decline because of domestic ties. For some time Mr. Blake was stationed successively at Brest, France, the Imperial Observatory at Paris, and the Royal Observatory at Greenwich. This was the occasion of the third and final determination of the difference of longitude between Greenwich, Paris and Cambridge, and all the observations were made by him.

These are but a few of the important expeditions with which Mr. Blake was connected while employed by the government. Within a month of his resignation he had begun a series of important experiments leading to the invention of the Blake transmitter. He has also secured patents for some twenty other inventions of minor importance, most of them pertaining to the telephone.

Mr. Blake's home, Keewaydin, which is situated in the southeastern part of the town of Weston, is one of the most beautiful in the suburbs of Boston. At the gate which leads into the grounds is a sign welcoming visitors, with the one restriction that they shall confine their visits to certain hours of the day—a restriction which the abuse of hospitality has rendered necessary. The estate, which is about 100 acres in extent, occupies one of the highest of those rolling elevations which characterize the surface of Weston. Its most beautiful aspect is presented to the passengers on the Boston & Albany railroad, which circles the foot of the southeastern slope. The ascent of the hill on this side is accomplished by means of a giant stairway, the slope having been excavated so as to form a series of broad terraces built of massive stone walls 20 feet high, the whole surrounded by a lofty outer wall. Overtopping all is the modern brick mansion shown in the picture, from the windows of which a broad outlook of rolling hills and miniature valleys reaches away to the blue mountains in the distance. In the foreground is the valley of the Charles, at this point dotted in the summer with all manner of small pleasure craft, and beyond an occasional glimpse of roofs and steeples locate the towns of Waltham, Belmont and Lincoln. Adjacent to the house on the northeast is a bit of landscape gardening which may not be duplicated in this country. This is a sunken garden, modeled after one which Mr. Blake had seen at Hampton Court in England. In the center of the garden is a large sun dial imported by Mr. Blake from Europe which the manufacturer declared was not equalled in workmanship by any in the world. During the summer months this spot is brilliant with velvet lawns, potted plants and graceful palms and ferns.

The stable buildings, which are constructed of brick, are grouped around an interior court yard, and in addition to the ordinary stable accommodations, comprise a cottage for the coachman, a mechanical laboratory, experimental and photograph rooms, bowling alley, and, most novel of all, a miniature theatre, with a seating capacity of about 100, fitted up with all the accoutrements of a first-class playhouse. In one of the buildings is a boiler room, from which the stables and the house are supplied with steam heat through under-ground pipes. The estate is furnished with a complete system of water works, including a reservoir holding a quarter of a million gallons, with a head of 110 feet.

Mr. Blake is a member of a great number of social and scientific clubs. Among the number is the Somerset club, the most exclusive social club in Boston, whose members he has several times entertained at Keewaydin. He is a public spirited man, and his townsmen have shown their appreciation of his devotion to the interests of Weston by conferring upon him the offices of selectman, and overseer of the poor. As a remuneration he receives $25 a year for discharging the duties of the first and $50 for the second, which revert to the town through the public library.

## The Electric Cable Road of the Stanserhorn, Switzerland.

The Lake of Four Cantons (Lake Lucerne), which is truly in the heart of Switzerland, is surrounded, says *La Nature*, by fold upon fold of mountains—a continuous circle, as it were, from Lucerne to Fluelen.

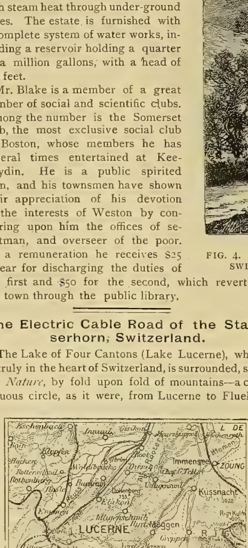


FIG. 1. THE ELECTRIC CABLE ROAD OF THE STANSERHORN, SWITZERLAND.—MAP OF THE VICINITY OF THE LAKE OF THE FOUR CANTONS.

Here are graceful and verdant fields, there grand and severe barrens, the rocks polished and the waters wild and restless, falling nearly vertically, forming a weird and charming scenic variety. The lake attracts all tourists, and when it has been sufficiently studied and admired it is considered the proper thing to ascend the mountains which surround the beautiful waters, to the end of admiring them from a new point of vantage. So modern enterprise has been led to invent railroads with steep grades.

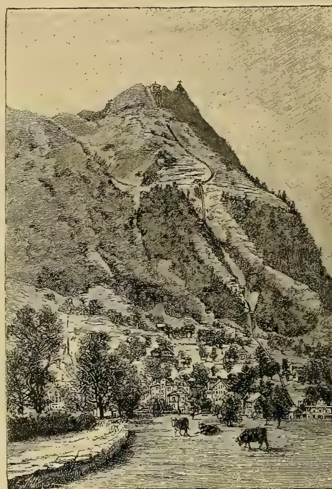

FIG. 4. THE ELECTRIC CABLE ROAD OF THE STANSERHORN, SWITZERLAND.—GENERAL VIEW ON MOUNTAIN SIDE.

In Europe the seat of this species of transportation is in the Swiss mountains.

First came the cog-wheel rack and pinion road of Witznau-Righi, shooting boldly along the flanks of this mountain, which to the north towers over the plain between the two lakes, the Zug and the Four Cantons. Latterly the system has been expanded by a new line to Goldau, and an extension to Scheideck. It has also made its way to Pilate, the summit of which has an attitude of 2,125 meters, and overlooks Loppenberg. Fig. 1 is a map showing the geography of the region.

All these lines of steep gradients, of which the construction has been carried on in the midst of every variety of difficulty, present a considerable technical interest, and we can readily appreciate the fact that the trip through these picturesque fastnesses should testify to the ability of the railroad engineer.

While the grade of these mountain lines did not exceed 7 per cent the ordinary locomotive was able to cope with the difficulty, the Utilberg being a striking example; but above this grade the cog or the cable system became necessary. The ascent to Pilate, for instance, has no less a grade than 45 per cent. A grade above 25 per cent required a cable and the adoption of a system similar to that employed in the mine industries, where the car is more or less completely suspended upon the cable which moves it.

This mountainous country contains many examples of cables, either simple or combined with rack and pinion gear, the motive power being derived from some neighboring waterfall. Examples of this system are seen in the Giessbach line, in that of Territet-Glion, and an intramural line at Zurich.

In some of the more recent applications the cable is driven by elecricity, the generators being driven by water more or less distant from the power house. This is the case, for example, in the Stanserhorn line, the latest and not the least curious of the high grade roads about Lake Lucerne.

The length of the line is 3,715 meters, and it rises from Stans, at an altitude of 458 meters, to the summit of the Stanserhorn, where the altitude is 1,900

meters, its water power being a fall at Buochs, four kilometers away on the river Aa, one of the streams running into the lake. A turbine of 150 horse power here, furnishes the power not only for the railway, but also for a small trolley line connecting the village of Stans with Stanstadt, and also the cable line of Burgenstock and Kehrsiten, which climbs an altitude of 870 meters. Further than this the two hotels, one on the summit of the Stanserhorn, Fig. 3, and the other at Burgenstock, are lighted electrically from the same power house.

The Stanserhorn road is divided into three sections, each having its own power house and an independent cable. At each of these stations there is a motor run by the current from the general station at Buochs, these being geared to actuate the two pulleys of 4.5 meters diameter upon which the cables of ascent and descent are wound. These pulleys make but five or six revolutions per minute, which gives the cable a motion of about 60 to 80 meters. The cables are of steel wire, the smallest, which has the least grade to combat, being 25 millimeters diameter, with a breaking strain of 25,000 kilogrammes—more than ten times what can ever be called for. In the upper sections the diameter of the cable is increased to 32 millimeters. Each section has two cars, one moving in each direction. Passengers change cars at each section terminal.

The road is single tracked, but guides are arranged upon the wheels and rails which prevent the possibility of derailing either on the straight line or at the passing points. Automatic brakes, which act at once on the stopping of the cable, render accidents nearly or quite impossible. In addition to this emergency system there are brakes at the command of the conductor, which may be manipulated by either hand or foot power.

A telegraph line extends the length of the road, and at any point along the line the conductor can establish communication with the electrician by means of a contact pole which each car carries, and thus stop the dynamo at will. The engineer has also an indicator with a traveling pointer showing the exact position of the car at all times, and automatically shuts down the cable when the car reaches its destination. The time upon each of the three sections is as follows: First section, 13½ minutes; second section, 18 minutes; third section, 21½ minutes; total, 53 minutes.

The first section ends at Kälti, Fig. 2, at an altitude of 714 meters. The average grade is 12 per cent, but this increases, as the summit is approached, to 27 per cent as shown in Fig. 3. The lower extremity of this section crosses a cultivated plain where the verdure and other evidences of civilization contrast strikingly with the wild and uncultivated lands toward the summit of the mountain.

The second section, Kälti to Blumatt, reaches an altitude of 1,221 meters, with a much more pronounced grade—60 per cent in some localities. Forests of firs are first crossed by the road; then, as it rises, it threads its way through a country wild to savagery, through a gorge with steep, ragged sides along the edge of a mountain torrent, with strong walls as protection from sudden inundations.

Still onward and upward, over the third section which reaches the summit, the grade is 60 per cent and the country traversed is bare and rocky, the denuded surface contrasting boldly with the pleasant verdure seen an hour ago at the foot of the mountain. Here the road passes through a tunnel of 150 meters in length, crosses veritable abysses upon a viaduct, the construction of which at this dizzy height is a marvel of engineering ingenuity. In a general way, over the greater portion of the road it has been necessary to construct retaining walls, terraced hedges, etc., on the flank of the mountain to arrest the dislodged rocks from above.

The road at its summit terminal lands the traveller in a tunnel underneath the hotel, about 50 meters from the top of the mountain peak proper. Fig. 3 shows this portion of the road, and Fig. 4 gives a general view of the entire line, from valley to summit.

From the top of the mountain the view is incomparable. Rozberg and Burgenstock peaks, from this point, seem like hillocks, and the sweep of country surrounding the tourist is unobstructed. At the north are seen Lucerne, Argovie, Zurich and Zug, the chains of the Jura and often Black Forest. Pilate raises its massive head to the northwest, with its Tomlishorn and Esel, at the west Schwarzberg with its Oberland-Bernois, and in the valley below snuggle under the hills, Alpnach, and Sarnen, at the south-west the snowy ranges of the Oberland-Bernois glaciers, and at the south the glaciers of Wallenstock and others well known. The panorama of the north-east includes the mountains back of the lake and sundry peaks and villages as far as Righi.

## A Year's Electrical Progress.[1]

By Charles G. Armstrong.

The year 1895 has been to the electrical interest one of steady, healthful growth all along the line of its many branches. In fact, the thorough weeding out which it received during the latter part of the year 1893 and the beginning of the year 1894 could have no

FIG. 2. THE ELECTRIC CABLE ROAD OF THE STANSERHORN, SWITZERLAND—ROAD AND STATION AT KÄLTI.

other result than a beneficial one, and when the business once began to recover from the agitation of such weeding a legitimate and healthful tone has characterized it ever since. It is true that it has taken investors some little time to recover from the fright of the recent panic, but all the interests that were founded on sound business principles have been well supplied with capital throughout the present year, as the numerous new railroads, electric lighting and other electric plants will testify.

### ELECTRIC RAILROADS.

During the year 1895 we who live in Chicago have seen the electric railway penetrate the heart of the city and ramify its branches throughout the entire residence districts in all directions. We have seen the great cable companies equipping car line after car line with trolleys and converting the slow-going, unsatisfactory horse-car into the switter-moving, smooth-running and far more satisfactory trolley. Much has been said during the year 1895 regarding the "deadly trolley," and a great deal of misinformation has been published regarding the same. It is perhaps sufficient to say in this connection that so far as pertains to the trolley itself there have been no deaths in Chicago during the past year, and but one or two throughout the United States. While the trolley cars have killed 500 or 600 people during the present year in the United States, these deaths have been only incidentally caused by the trolley itself. The electric current has had no part in the killing other than that it provides a quicker means of transit. People are customed to the slow-going horse-car will take chances in crossing in front of the trolley cars, which they would not think of doing with the cable or steam roads, and it is probably not necessary to state that should a car weighing 15 or 20 tons run over a person it would kill him whether it is driven by electricity, steam, gas engine or any other means of locomotion.

Many of the accidents due to the trolley lines are caused by the inexperience of the motorman and the unreliability of hand-brakes. As a cure for these troubles the introduction of compressed air brakes is being advocated, and, in fact, put into practical operation. The benefit of air brakes on steam cars is so thoroughly understood that it needs no argument, and one need not be an expert in the business to understand that air brakes can readily be adopted in street-car work and will probably be the means of saving a great many lives.

Electric propulsion of cars, owing to the rotary motion of the motor, gives a steady impulse to the car, whereas the cable, owing to the long line of rope and unequal distribution of the load, gives a jerky and unpleasant motion, which, coupled with the fact that quicker time can be made on trolley lines, makes them very popular with the people. Much of the hue and cry against the trolley, the writer has noted during the present year, has been made by men who ride in carriages and seldom use the street-car lines, but the majority of people who think and reason for themselves are satisfied with the electric lines, and would not exchange them for the horse lines under any consideration.

As to the overhead or underground trolley, the question still remains unsettled. Numerous good plans have been suggested during the present year, and the writer has seen some of them in operation, but with the exception of the line in Washington, which is about eight miles long, none of them has been put into practical use, owing to the first cost and the uncertainty and expense connected with the introduction of new apparatus. The trolley line, with center-pole construction, using 500 volts pressure, is at present a very safe and economical method of transmitting power to a car. It has drawbacks, the most serious disadvantage being the presence of other wires. It has been clearly demonstrated during the last several years that it is perfectly practical and possible to place all wires underground except trolley wires. If the telephone, telegraph, electric light and fire-alarm wires were placed underground, as they should be, there would be no possibility of their falling on the trolley wires, consequently the annoyances of burning out of telephones and destruction of property from contact with the trolley wires would be entirely avoided. The other solution to the problem of transmitting power to the car, the underground trolley, will probably be successfully accomplished, but at present, during the embryonic state of underground transmission, the best thing would be to put all the other wires underground, use center-pole construction for the trolleys, and rest assured that very little, if any, harm can possibly come from the use of the trolley.

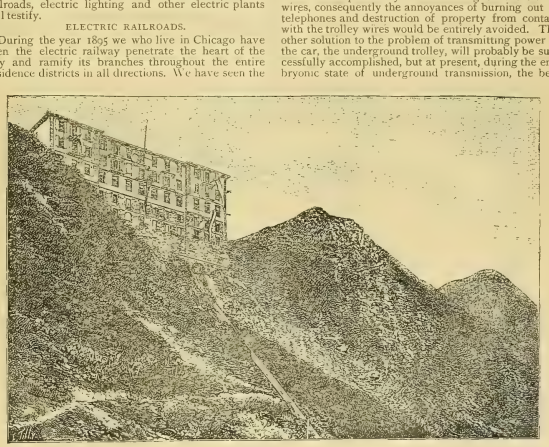

FIG. 3. THE ELECTRIC CABLE ROAD OF THE STANSERHORN, SWITZERLAND. HOTEL TERMINUS AT THE SUMMIT.

### SEEKING CHEAPER FARES.

One of the great benefits from the introduction of the trolley is the recent agitation for a three-cent

1. From the *Chicago Record*.

fare. This has been accomplished in the city of Detroit, and will undoubtedly be accomplished in Chicago and other places in the near future. It is the inevitable result of a cheaper and better mode of propulsion. The cost of propelling cars on the Alley "L" road, where steam locomotives are used, is more than twice as much as the cost of propelling cars on the Metropolitan road, where electric power is used. It does not need a financier to appreciate, therefore, why it would be possible to reduce fares and still make a reasonable profit on a street railway investment where electricity is used.

The year 1895 has demonstrated to the Baltimore & Ohio Railroad company the practicability of electric locomotives. One which is now in use in Baltimore will move 44 loaded freight cars and three dead locomotives at one time. The total weight of this train is 1,900 tons. No steam locomotive has ever even approached this record. The efficiency of this locomotive no doubt has much to do with the rumor that some of our suburban steam roads are to be equipped with electric locomotives.

### STORAGE BATTERIES.

The storage battery has been improved much during the present year. The batteries, while they have not been made much lighter, a thing which we all hoped to do, have been made more substantial and better in a great many ways. A storage battery railroad has been promised for Chicago, and in fact franchise has been granted for 54 miles of storage battery road in our southern suburbs. It is sincerely hoped that the results will prove better than experiments have shown, which experiments have been invariably failures. Storage batteries for isolated lighting plants are being introduced, especially for country residences, where they are used in connection with gas and gasoline engines, with a considerable degree of satisfaction and success.

### ELECTRIC POWER.

There has been a phenomenal growth of power transmission during the present year. As predicted in last year's article, this system of transmitting power in large factories has come to stay, and it is more appreciated as the months go by. There have been installed in the immediate vicinity of Chicago thousands of horse power in motors, displacing cumbersome shafting and belting everywhere, factory owners preferring the silent, unobtrusive, tractable electric current to the noisy, greasy, uncertain belting and line shaft.

The alternating current motor has come prominently to the front as a power-transmitting device. It has fewer parts than the direct current motor, and possesses many features of reliability, and especially in long-distance work it has a field which can never be occupied by direct current apparatus.

The general lighting system by alternating currents, especially the two-phase variety, has taken a decided advance during the last year. One of the largest plants which have been installed during the

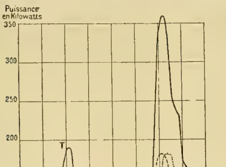


FIG. 3. CONSUMPTION OF ELECTRICITY IN PARIS.—CURVES SHOWING THE PRODUCTION OF THE CENTRAL MARKETS STATION (A, ALTERNATING; C, CONTINUOUS; T, TOTAL).

present year has been the Pabst power plant in Milwaukee, where preparations have been made to supply 50,000 incandescent lights scattered throughout the city of Milwaukee. The installation of this plant establishes the fact that the alternating system can be thoroughly relied on for general distribution of light, heat and power, owing to the very small amount of wiring used, as compared with the cumbersome and unsatisfactory transmission through direct current.

### ELECTRIC LIGHTING.

One of the most notable advance movements during the year has been the general introduction of electric light plants in small country villages throughout the whole Northwest. The country villages are building electric light plants to supply arc and incandescent lighting; in many cases they supply lights to private consumers, although in some states they are prohibited from doing so by law. While the writer does not believe in municipal ownership of electric light plants, or, in fact, anything that can be owned and run by private capital, yet there are many cases where such ownership is justified, notably in small cities where no one would be warranted in installing a plant for private use. These plants are installed at public cost and supply the citizens with modern means of lighting their homes and streets. In many cases under the writer's observation these plants are paying all expenses and some profit to the city.

The alternating arc lamp has proved itself an extremely useful agent of the electric lighting system, is thoroughly established and is reliable and satisfactory.

Incandescent lamps have greatly improved during the year, owing to the expiration of the fundamental patents, the result being that numerous companies have started up, and sharp competition arising therefrom has greatly reduced the price and improved the quality, although there is much yet to be accomplished in improving the efficiency of incandescent lamps. In fact, with the present method of generating current with dynamos of from 92 to 95 per cent. efficiency, the only room for improvement lies in the lamp itself.

### ISOLATED LIGHTING PLANTS.

Throughout the city of Chicago there has been a noted increase in the number of isolated electric lighting plants installed in buildings. It has been the practice among certain architects and owners to establish expensive steam plants in their buildings for warming the same and operating their elevators, and contracting with public venders of electricity for lighting the same, paying the electric light companies enormous sums therefor; in one case which the writer has noted this sum has run as high as $100 a day. These people have found, upon better advice, that by installing their own plants, with scarcely any addition to their expenses and very little to their working force, they were enabled to light themselves with the steam plant which heats their building, it being a well-known fact that exhaust steam is almost as valuable for heating purposes as live steam—that is, after the steam has passed through the engine it contains almost as many heat units available for heating the building as it would have when used directly from the boiler.

### TELEGRAPHY.

Many improvements have been made in telegraphy during the year. These improvements, however, have been in the line of perfecting and simplifying the apparatus in use. One of the most important changes of telegraph companies in the last year has been the removal of the Postal Telegraph company from its quarters in Jackson street to the Stock Exchange building, corner of La Salle and Washington streets. One not familiar with the thousand details of a plant of this kind can scarcely appreciate the enormous undertaking of bodily removing all instruments, wires, etc., in connection with a colossal telegraph business, and when I state that this moving was done without any perceptible interruption to the service, the care and the great ability exercised by the officers of the company in handling the work will be appreciated.

The serious sleet-storm of this fall has not proved itself an unmixed calamity, as, while serious damage has been done to outside wires, there has been awakened a discussion tending to a more substantial method of communication between cities, so that sleet-storms cannot interfere with the telegraph service, and it will not be at all surprising to see, within the coming year, something adopted in this line.

### TELEPHONING.

Numerous improvements have been made in telephone work during this year, one being the introduction of the "main express" system, which consists of a switchboard, provided with small lamps for signaling apparatus. This does away with the magneto or transmitting instruments at the telephone. To call the station you simply take down the receiver. This act lights a small lamp, which signals to the operator that you want something. When you are through talking another lamp signals that you are through. It facilitates connection, as it notifies the operator more positively of your wants than does the old system of drops. It seems singular, however, that the commissioner of public works should permit the telephone people to so violate the terms of their agreement with the city, by the introduction of what they call their metallic lines and the express service by which they are enabled to charge from $50 to $100 per year more for telephones than their charter permits them. In their charter they agree to furnish telephones to all parties for $125 a year, and to furnish all improvements from time to time as they are made. Instead of doing this, for improvements which they make they charge subscribers extra money, and by giving more attention and quicker service to the improved and consequently higher priced apparatus they compel people to use it, making the uninitiated believe that it is the apparatus which gives better service rather than their employes. The writer has maintained that a telephone company can furnish instruments for not to exceed $75 a year, and that it should be compelled to do so.

The telephone interest received a serious set-back in a very unfortunate decision of one of our courts relative to the Berliner patent. However, this decision has been promptly taken to the Supreme Court and will undoubtedly be reversed. It seems strange indeed that any judge could find that a company could hold a patent in the Patent Office for 12 or 14 years and then have it issued in such a manner as to prolong the life of the original patent to nearly twice that which it is allowed by law. The patent situation, which was extremely clear before this decision came out, is now in such condition that capital will not readily invest in some forms of telephone which should be open to the general public. In fact, it is an extremely unfortunate thing that the decision of patents, and consequently the fate of mechanical apparatus, should be left entirely in the hands of judges whose training has been entirely in the matter of law and not in machinery. It is safe to say that many of our patent decisions are made by judges who have at most but a superficial knowledge of mechanical appliances.

### NEW AND SPECIAL APPLIANCES.

In the new and special appliances in electricity some advancement has been made. The Tesla vibrator for the production of light without the use of wires and lamps is still in an experimental stage. Another system which consists of a vibrator in a

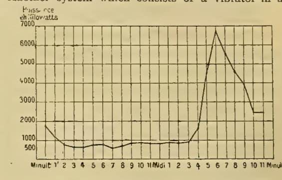


FIG. 2. CONSUMPTION OF ELECTRICITY IN PARIS.—CURVE SHOWING THE TOTAL CONSUMPTION OF CURRENT FOR ONE DAY IN OCTOBER, 1895.

vacuum in a receiver containing a rarefied gas has been brought out and promises much in the way of a new method of producing light by electricity, and the year 1896 may possibly see the same introduced in some practical form.

In the manufacture of ozone a plant which has been running for the last year in the Champlain builing in this city has demonstrated that electricity has a peculiar field for the production of this valuable agent, which has been found to be very serviceable in the cure of pulmonary diseases and in the destruction of fungus growths, while even cancers give way to this powerful agent.

Electricity has been found very useful also in pickling iron wire. This is a process which has always been conducted by the use of acids, the object being to remove the scale from the wire just previous to galvanizing it. The scale is eaten off by the acid and the weight thus removed is lost. In the electrical method the scale is torn from the wire by electrolysis, and instead of being lost is deposited on the opposite pole in a chemically pure iron worth about $30 a ton. This by-product is of sufficient value to pay for the cost of the current. Numerous factories are being built now with a view to using this process, the result being that galvanized wire can be produced cheaper and with a more uniform coating.

Much has been done during the present year in developing the electric furnace for reducing various refractory substances. It is well known that heat from the electric arc is very intense, and by a proper arrangement of current large quantities of ore can be smelted, and, owing to the extreme heat, separated from many of its chemical compounds.

### FIRE PROTECTION.

Regarding the general introduction of electricity into homes, factories, office buildings, etc., the question of fire risk has been one of considerable importance, and one which is being handled in a masterly way by the insurance companies. In order to arrive at the best possible means of wiring, the insurance companies have established a bureau of investigation. This bureau takes the various appliances designed for electrical work, tests them thoroughly under all practical conditions, and reports on the same. They also, in case of fire, report the exact cause of the fire, if from electrical causes, just what occurred, in order that the danger points might be guarded against in the future. These reports are sent out to various people interested in the electrical profession, and uniformly good results are being obtained therefrom. This system was inaugurated by W. H. Merrill, Jr., of this city, who is an electrician of more than usual promise, and to whom great credit is due for the systematic way in which this bureau has been organized and is being carried on.

As a whole, the year 1895 has given to the electrical profession much, the gain being largely in the incidentals of the business, the minor points of the various appliances pertaining thereto, the electrical profession, as one man, working during the present year toward perfecting and improving, toward making safer and more reliable, toward more thoroughly establishing in the minds of the people the legitimate uses to which electricity can be put, and while no one thing has been startling, yet as a whole the business stands on a firmer foothold to-day, on the threshhold of 1896, than it did on entering the year 1895, and we who are most interested in the development and growth of the same sincerely hope that when we enter on the year 1897 we will then have, through our concerted efforts, placed

our calling on a still higher footing and that we will have convinced the general public and investors in electrical apparatus that there is in electricity a vast field for practical performance and profitable investment.

## Consumption of Electricity in Paris.

The use of electricity in Paris has grown in importance quite rapidly during the last few years. The following data are obtained from the proceedings of the International Society of Electricians:

Electrical energy is furnished in the metropolis by central stations and by individuals. These latter have supplied current since 1873, but the first central station of the city dates from the 21st of June, 1887. In 1889, just previous to the exposition, the Municipal Council granted franchises to several companies to carry their conductors under the streets of Paris. The first of these companies were the Continental Edison, the Electric Light & Power company and the Popp company. At the same time a municipal installation was inaugurated for lighting the Central Markets and the vicinity. In 1890 a new company was formed under the name of the "Societe du Secteur de Clichy" (the Clichy District company) for furnishing power throughout that quarter of Paris. In 1892 the Champs-Elysees District company and in 1893 the Left Bank District company were formed.

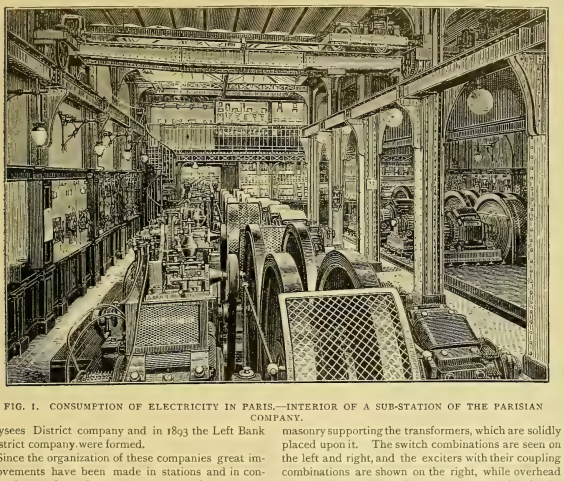

FIG. 1. CONSUMPTION OF ELECTRICITY IN PARIS.—INTERIOR OF A SUB-STATION OF THE PARISIAN COMPANY.

Since the organization of these companies great improvements have been made in stations and in construction work, and a general review of the present status of these various organizations and their work, at the close of the year, may not prove uninteresting.

The Edison Continental company has adopted the three-wire system of distribution, and has three central stations—one at the Cite Bergere, one at l'avenue Trudaine and one at the Palais Royal. These three stations can be connected in parallel or operated as three distinct stations. There is also a sub-station of accumulators installed in rue St. Georges. The total capacity of the company is 2,400 kilowatts, but a new installation in process of construction at the Trudaine station will increase this capacity to 3,080 kilowatts. There are 88,000 ten candle power lamps, and 30 motors with a total power of 36.8 kilowatts, furnishing light and power to patrons.

The Light & Power company has its primary station at Saint Ouen, furnishing high-tension continuous current, with a capacity of 600 kilowatts, for power at the secondary stations of Barbes and the passenger depot of the Northern railway. Other steam central stations are located in the rue de Bondy, rue des Filles-Dieu, at the Stock Yards and at La Villette. The total power is 2,025 kilowatts which will shortly be raised to 2,525 kilowatts by the new extensions in progress at Bondy. These stations furnish consumers with 70,000 ten candle power lamps and 35 motors calling for 90 kilowatts of power.

The Clichy district is one of the most complete and best established of Paris. The five-wire system is used, the conductors being laid in lead and armoured cables. The company has a service of 100,000 lamps of ten candle power and 67 motors consuming 176 kilowatts of power. The excess of motors here is accounted for by a more general adoption of electric elevators in this neighborhood.

The Popp company, otherwise known as the Parisian Electric & Compressed Air company, has two central stations, at Saint Fargeau and at the boulevard Richard Lenoir, with a total of 2,200 kilowatts capacity. In these stations the dynamos furnish continuous currents of 2,000 to 3,000 volts for charging accumulators in 25 sub-stations, which serve as centers of distribution. Besides these batteries there are a number of rotary transformers (motor generators). The company intends replacing all these sub-stations by two or three stations of greater capacity. Within the last year this company has established the sub-station at Saint Roch, which is the model for the new stations. Fig. 1 gives an illustration of the interior of this plant. It includes two groups of four transformers of 80 kilowatts, and a group of four of 40 kilowatts. The secondary distributing circuits feed the district of Vendome with a five-wire system. The arrangement of this station is excellent. In the center is the foundation of masonry supporting the transformers, which are solidly placed upon it. The switch combinations are seen on the left and right, and the exciters with their coupling combinations are shown on the right, while overhead the traveling crane gives excellent service in the way of transporting and handling heavy machinery. Temporarily this station is fed from the Richard-Lenoir station. Another sub-station is in course of construction at quai Jemmapes, with a capacity of 2,400 kilowatts for the present, which will also use the five-wire system. The feeders for this station will be at the Saint Roch station, coupled in parallel with the secondaries of the transformers spoken of above.

The Champs Elysees company has an output of 1,200 kilowatts and feeds 75,000 ten candle power lamps and 15 motors of 25.7 kilowatts.

The Rive Gauche (Left Bank) company has had its station since 1893 in the Place du Pantheon. It is now constructing at Issy, on the bank of the Seine, a central station, which will include 10 Ganz alternators of 400 kilowatts at 3,000 volts with 42 periods per second. The conductor cables will be of the Felten & Guilleaume concentric type, in armored lead, insulated with jute and paper.

The municipal station in the Central Markets has now, as originally, a total capacity of 570 kilowatts, 240 of continuous and 330 of alternate current. There are also four Desroziers dynamos of 42.5 kilowatts for charging accumulators and an alternator of 38 kilowatts.

If we aggregate the above, we find that there is at the close of 1895 an electrical output in the French capital of 10,965 kilowatts, and there are yet to be installed 7,980 kilowatts additional. The total number of ten candle power lamps installed is 454,567, and 154 motors, consuming 331 kilowatts in power.

Fig. 2 gives a diagram of the total output of a day at all of the central stations of Paris. The curve shows a sudden drop at midnight and it holds the drop quite persistently during the day, at 5:30 to 6:00 kilowatts, but at 4 P. M. it suddenly jumps, arriving at a maximum of 6,778 kilowatts, and almost immediately commences to lower again. This curve represents quite perfectly the daily consumption with the exception of the municipal plant at the markets, where the early morning requirements materially affect the form of the daily curve of consumption.

Fig. 3 shows the curves of production in continuous currents *C*, in alternate currents *A*, and the total. One maximum will be seen at 6 A. M. and another at 6 P. M.

In spite of the competition of the Auer incandescent gas burner, the consumption of electricity has gradually increased. In 1889 and 1890 the number of kilowatts sold was respectively 480,784 and 2,284,485, in 1894 it had risen to 7,883,454, a constant increase being shown for each of the intermediate years.

In addition to the public stations mentioned there are in Paris, many private plants, more or less extensive, pertaining to theaters, passenger stations, hotels, stores, cafes, restaurants, etc., and to manufacturing establishments. At the close of 1895, these will aggregate 25,760 horse-power of which 23,000 are actuated by steam, 2,260 by gas and 500 by compressed air.

Totalizing the power of the central stations and the private plants we have a total of 48,700 horse-power of steam utilized for electrical generation, out of a total of 80,000 installed in the city for 1895, which plainly indicates the growth of the use of electricity both for illumination and for power. The cuts are from *La Nature*.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Bishop Telphone Exchange has been incorporated at Central City, Ia., with $30,000 capital stock. This company has already begun active work and will soon have several lines constructed. One line that between Central City and Prairieburg, is in working order. Connections will be made with Coggon, Paris and Troy Mills.

G. S. Barr, of Britt, Ia., proposes to put in a telephone system at Waseca, Minn. He has secured over thirty contracts for instruments there, with others promised.

The local telephone company at Detroit, Minn., has found it necessary to raise its rates for business houses to $2 per month payable semi-annually in advance.

Mr. Fargo, of St. Paul, has closed a contract with the newly formed telephone company at Fairmont, Minn., to put in an exchange there.

The telephone committee of the Mankato, Minn. Board of Trade has reported that a telephone system can be put in for Mankato and vicinity for $7,550, or less.

The local exchange at Baraboo, Wis., is completed. It is put in by Frank and William Bell, of Winona, Minn.

The Wisconsin Telephone company is offering to put in instruments at Wausau, Wis., free of charge and is actually making a canvass of the town for subscribers at those terms. The local company, which has forced this attitude by the Wisconsin company, has such a hold at present that but few have accepted the gratuitous service. These few are being "guyed" by press, and probably by people, unmercifully. It is said that those who did take the free service were some of the worse "kickers" against the Wisconsin Telephone company in the town. Rates have been reduced by the Wisconsin company at Stevens Point 25 to 50 per cent., which is attributed there to the fight going on at Wausau. Centralia, Wis., which is having a local exchange projected, is offered a 25 per cent. reduction.

C. P. Wainman, superintendent of the Northwestern Telephone Exchange company, in an interview at Mankato, Minn., warns the people against local exchanges, which, he says, are put in by stock being subscribed; the exchange is then equipped for half the money subscribed, and the remainder of the funds go into the projectors' pockets.

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Correspondence relating to electricity or any of its practical applications, is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

Advertising.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A LEAD WHICH CAN BE HELD BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK

CIRCULATION, 16,630.

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THIS number of the WESTERN ELECTRICIAN is issued under difficulties, and we are compelled to ask the indulgence of readers and advertisers for a day's delay and the slightly changed appearance of the paper. The situation is due to a fire in our printing establishment on the night of Saturday last, by which the composing room was gutted. At that time the leading matter for this week's paper was almost entirely in type. After the firemen had left the building it was found that the contents of the "galleys" were a total loss and that much copy and proof had been destroyed. The paper had to be entirely remade in a strange printing office, and we trust that the result of the extra labor made necessary by this embarrassing accident will be found acceptable.

Perhaps only newspaper men can rightly appreciate the annoyance and confusion of such a disaster. It may be mentioned, for one thing, that although twenty-two page "forms" of advertising were saved, it was found necessary to reproduce nearly 100 distinct advertisements in the size and type of the original. This has been accomplished, it is believed, without omission, and in a much shorter space of time than would have been deemed possible.

If any omissions or errors have occurred, we will be thankful to any reader, contributor or advertiser who will point them out. We expect to issue the next number amid surroundings more nearly approaching the normal.

THAT vigorous youngster, the Northwestern Electrical association, will hold its fourth annual convention and seventh meeting at the Hotel Pfister, Milwaukee, on Wednesday, Thursday and Friday of next week. Papers will be read by W. J. Buckley A. V. Abbott, Maurice Barnett, J. C. McMynn, E. R. Cunningham, Fred DeLand and others. Generating machinery, fuel value, storage batteries, power transmission and municipal conditions, and their relations to central station work, will be discussed. The meeting is sure to show a judiciously blended result of instruction and entertainment, and undoubtedly will, as it certainly should, be largely attended.

ACCORDING to the testimony of H. H. Vreeland, president of the Metropolitan Street Railway company of New York, before the General Assembly committee on railroads, as reported in the daily papers, the Lenox avenue line, which is operated by underground electric trolley, is carried on at a loss. Nevertheless the company is experimenting on lines now operated by horse power, with a view to substituting the underground trolley. No storage battery system, Mr. Vreeland says, has been found practicable. Under the circumstances it is hardly possible that the underground trolley system will be extended, as has been reported; at least, not until it can be shown that the lines upon which it is proposed to introduce the conduit system can be operated at a profit.

ONE paragraph of the opinion of Judge Townsend in the recently decided patent suit on the underrunning overhead trolley for electric railway cars should command the thoughtful attention of patent attorneys. We refer to the remarks of the court on the useless prolixity of recorded evidence in patent cases. On this point the judge says: "The record is padded unnecessarily with irrelevant matter. Complainant's record covers three thousand one hundred and forty-two pages; that of defendant two thousand two hundred and thirty-seven pages. The issues directly involved do not warrant the taking of such an inordinate mass of testimony nor the introduction of such a confusing number of exhibits. This rapidly growing abuse in patent suits, if persisted in, must seriously interfere with the present practice of presenting, in an opinion, the results of a full consideration of all the important issues in such cases. If admonition will not answer, the next step must be the punishment of the offending party by the imposition of costs."

This is a well deserved rebuke. The attorneys, by the great volume of more or less expert testimony, usually add to the perplexities of the judge rather than extend the aid of officers of the court; they pile up needless expense, and simply appall the interested public desiring to inform itself as to the main outlines of the case. The record should be made as brief as possible, consistent with a clear statement of the evidence necessarily bearing on the case. It is perhaps not to the interest of the attorneys to set forth the facts in the case compactly and concisely, but such a reform would clearly benefit the litigants, the judge and the public. And the improvement need not stop with the advocates at the bar. There are not a few opinions handed down in patent causes that could be greatly bettered by a judicious pruning-down process. The learned judges themselves, we venture to say, are not all blameless in this direction. An opinion can be carefully reasoned out, logical and meaty without wandering into uncounted thousands of words of dissertation and quotation of precedent. The non-legal technical reader welcomes the short, clear, exactly expressed opinion with joy because he has known the other kind so often to his sorrow.

WE COMMEND to the appreciative consideration of all our readers Mr. Armstrong's review of the electrical progress of the year 1895 which we reprint from the *Chicago Record*. The article is one of a series printed in the newspaper named to cover the general advance of the arts, science and commerce during the year. Each article is contributed by some specialist of reputation, and Charles G. Armstrong was asked to represent the electrical industry for 1895 as he had for 1894.

Mr. Armstrong gives us a clear, sensible, unprejudiced survey of the whole electrical field. He has no axe to grind and seems only desirous of stating to the general public the present state of the industry he represents. He takes a hopeful view of the situation and predicts a steady, healthy, legitimate growth. He exposes the fallacy of the "deadly trolley" cry, is rather doubtful of conduit trolley lines and is awaiting demonstration of the practicability of storage battery cars. He notes the phenomenal growth of electric power transmission, greets the alternating current motor and records the growth of electric lighting. He favors isolated lighting plants and makes a rather sweeping generalization in their favor. Mr. Armstrong is evidently heartily in favor of the anti-Bell interests in telephony, and he points out one feature of the local situation that appears to have been overlooked. This he discusses in the following words:

> It seems singular that the commissioner of public works should permit the telephone people to so violate the terms of their agreement with the city, by the introduction of what they call their metallic lines and the express service, by which they are enabled to charge from $50 to $100 per year more for telephones than their charter permits them. In their charter they agree to furnish telephones to all parties for $125 a year, and to furnish all improvements from time to time as they are made. Instead of doing this, for improvements which they make they charge subscribers extra money, and by giving more attention and quicker service to the improved and consequently higher priced apparatus they compel people to use it, making the unmitiated believe it is the apparatus which gives better service rather than their employes. The writer has maintained that a telephone company can furnish instruments for not to exceed $75 a year and that it should be compelled to do so.

This is a point worthy of the investigation of the city authorities Taken as a whole, Mr. Armstrong's article is an admirable resumé of the situation. We congratulate the *Record* on its good sense in going to an electrical engineer like Mr. Armstrong for its information. Other of the Chicago dailies that make themselves ridiculous by admitting the clamorous misstatements of the champion electrical politician; John P. Barrett, may well profit by the example.

IN ANOTHER column will be found an interesting article on the consumption of electricity in Paris. A striking feature is found in the fact that all of the lamps in use in that city seem to be of but ten candle power, while here nothing less than sixteen candle power lamps are tolerated for commercial use, and there is a very considerable demand for thirty-two candle power lamps and even higher powers for private use. This continent long ago emerged from the thraldom of the tallow dip and the sperm candle, the first considerable jump being to the mixture of turpentine and camphor called camphene, followed by manufactured coal-oil, and this by petroleum. The people of Europe are satisfied with a leap from candles and colza oil with a clockwork lamp to ten candle power lamps—an advance even greater than from coal-oil to sixteen or thirty-two candle-power electric lights. This is another proof that happiness is only comparative after all.

The aggregate figures given show that Paris is fairly well supplied with incandescent lamps, but that the gay capital makes a comparatively poor showing in the use of electric power. The figures are not available for exact comparison between Paris and Chicago, but some conclusions may be drawn by referring back to the statistics of service of the Chicago Edison company, given last week. Naturally, no one of the French companies can compare in extent of operation with Chicago's one great company, as in Paris the service is divided into districts, each of the companies supplying the territory assigned to it. Let us, then, glance at the aggregate of all the central station companies of Paris in comparison with the service of the one Chicago company. It will be noted that the total number of incandescent lamps connected with the Chicago equipment is 191,074, as compared with the 154,567 on the central stations of Paris. The distinction pointed out in the preceding paragraph must here be borne in mind, however, and, figured on the basis of ten candle power lamps, the figures for comparison would be, in round numbers, 300,000 and 450,000. In addition, it must be remembered that over one-third of the Chicago company's output is sold for arc lamps and motors. For arc lighting no returns whatever are given by the Paris companies, while the aggregate horse power in motors installed by the one Chicago corporation is ten times as great as that of the six companies in Paris. Calculating, in the equivalent of ten candle power lamps, the total of translating devices on the central station mains of the two cities, the figures are: Paris, 165,000; Chicago, 520,000. The total capacity of generating machinery in the central stations of the Parisian companies and the Chicago company is about the same.

## The Okonite Company's Plant at Passaic, N. J.

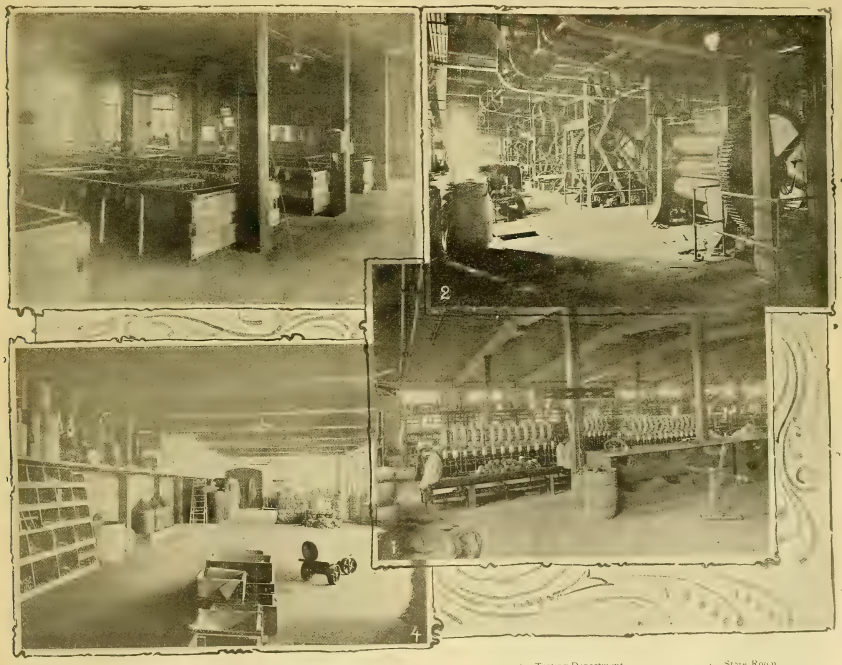
"Okonite" is a familiar word to every man even remotely connected with the electrical business. Wherever cables and wires are used, there the semi-circular trade-mark is known, so that it may be said in truth that the sun never sets on Okonite. The growth of the Okonite company, Limited, has been even more rapid and astonishing than many other electrical manufacturing companies. The elements of the company's success may be found in its intelligent and liberal management, the scrupulous and ever-watchful care exercised over its manufacturing department, the high and unvarying quality of its product and its brainy and broad methods of advertising. No firm in the electrical field has devoted more care and attention to its advertising, and few, if any, have spent more money than the Okonite company to direct public attention to its wares. The results achieved after little more than 10 years' effort speak for themselves. Today the company occupies an immense plant on the Dundee canal, at Passaic, N. J., which is kept busy filling orders for Okonite products; its head business offices occupy a whole floor at 13 and 15 Park Row, New York city; and its agencies are located in London, Rome, Yokohama, Shanghai, Buenos Ayres, Chicago, Boston, St. Louis, San Francisco, Philadelphia, Omaha, Cincinnati, Kansas City, Pittsburgh and Buffalo.

The Okonite company had its beginning in 1884, when J. J. C. Smith, Michael Smith and Herman Gelpcke organized the New York Insulated Wire & Vulcanite company, and established an experimental plant for the manufacture of insulated wire at College Point, Long Island. Here they began making a special form of insulation which has since become so widely known as Okonite. In 1885 the name of the company was changed to the Okonite company, and the plant was removed to Passaic, N. J. At this time the business was under the management of Charles A. Cheever, Willard A. Candee and George T. Manson, and remained so until 1888, when it was reorganized under the name of the Okonite company, Limited, with the present management, which is composed as follows: Willard L. Candee and H. Durant Cheever, managing directors; George T. Manson, general superintendent, and W. H. Hodgins, secretary.

In 1888, the present group of factory buildings at Passaic was commenced, and each year since then the rapidly increasing business of the company has necessitated the erection of new buildings and improvements in the old ones. Recently the plant has been thoroughly overhauled, the machinery rearranged for more accurate and rapid work; and new machinery added until it now stands perfectly equipped for the production of any kind of insulated electrical conductor, from the fine silk-covered wire used for lamp cord to the heavy, iron-armored submarine cable.

FIG. 1. THE OKONITE COMPANY'S PLANT AT PASSAIC, N. J. —INTERIOR VIEW OF BUSINESS OFFICES.

A representative of the WESTERN ELECTRICIAN recently spent a day in going over the Okonite plant in company with General Superintendent George T. Manson. The resulting impressions after the trip were the systematic arrangement of the various manufacturing departments, the immense capacity of the plant, the care and intelligent expert supervision exercised in the testing department and the extreme cleanliness observed in every step of making Okonite wire. The business offices are located on the second floor at the end of the building. They are light and commodious and equipped with a long distance telephone and other modern conveniences



1. Winding Department. 2. Calendering Department. 3 Testing Department 4 Store Room

FIG. 2. THE OKONITE COMPANY'S PLANT AT PASSAIC, N. J. INTERIOR FACTORY VIEWS.

for the rapid transaction of business. In a separate building, 125 by 50 feet in extent, is located the supply department, which occupies two floors This department is very complete in its arrangement and handles all raw material of very description used in the plant. Bare copper wire, iron wire, jute, yarn,

belting, fittings and parts of machines are here arranged in order ready to be supplied on requisition in an instant. It is a veritable store which sells the factory raw materials and buys them back again as finished.

The most notable fact about the boiler room is the apparent absence of fuel for the furnaces under the four boilers of 100 horse-power each. Crude oil, stored in tanks outside the buildings to the amount of 60,000 gallons, is used for fuel. It is forced through pipes by pneumatic pressure to the furnace doors, and there it belches forth in torrid flames, which bring the furnaces lined with fire brick almost to a white heat.

In the engine room is a 250 horse-power engine and three smaller ones for driving dynamos. Water-power to the amount of 200 horse-power is also obtained from the Dundee Canal. There is a Thomson-Houston alternator which supplies current for a Thomson welder, used in joining lengths of wire, and also furnishes current to the testing department for the voltage tests. A Thomson-Houston 450-light direct-current machine furnishes the plant with light.

The New England Engineering company, of Waterbury, Conn., A. M. Young, president, has just finished rewiring all the buildings and has installed a new switchboard and bank of transformers. Over 600 lights are now in service. When all are in use the alternating generator supplies a part of the current through transformers. The switchboard is composed of two slate panels carrying seven circuits and equipped with Weston instruments. It is so arranged that its capacity may be readily increased. Naturally the wire used in running the circuits is Okonite. It is all exposed and is carried on porcelain insulators throughout. The job is thoroughly up to date, and one that the New England Engineering company should feel proud of.

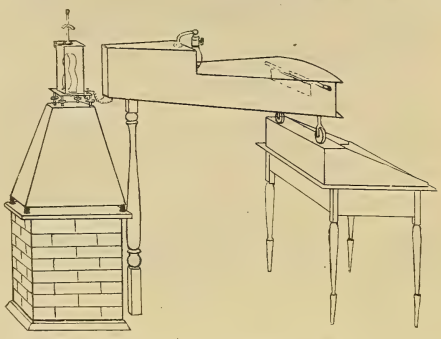


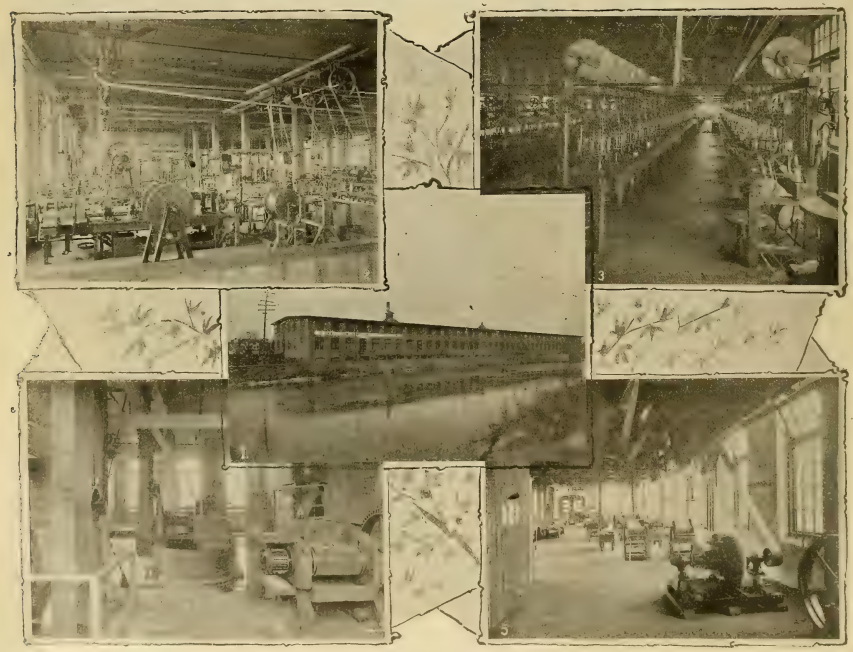
FIG. 5. THE OKONITE COMPANY'S PLANT AT PASSAIC, N. J.—DEVICE FOR MAKING TESTS IN A LIGHT ROOM.

The system of fire protection adopted is very complete. Every building is equipped with automatic sprinklers and at frequent intervals barrels of sand are placed. Many an incipient blaze may be quenched by a handful of sand that would only be aggravated and spread were water turned on it. This is especially true of burning oil or rubber. Every here and there throughout the plant is a hydrant, coil of hose and a fire axe ready for quick work when necessary.

A carpenter shop, machine shop and blacksmith shop occupy a building by themselves. Here all the wire and cable reels, packing cases and other wooden things are made, as well as all repairs. The company builds, from its own designs, a great many of its cabling, armoring and covering machines and a great deal of the special machinery employed in the plant. The largest cabling machine in use in the Okonite factory was built complete in this shop.

In making Okonite the finest obtainable quality of pure Para rubber is used. In the immense drying rooms, kept at the proper temperature by covered steam pipes laid along the floor, 50,000 pounds of rubber is kept hanging on the racks at all times. As fast as the rubber is used the stock is replenished. The rubber washing room has a cement floor and is as clean as a Dutch kitchen. It is fully equipped with washing tanks, grinders and other machinery, which breaks and crushes and kneads the rubber until every foreign substance is extracted.

When the bare copper wire is received it is carefully measured, gauged, tested for conductivity, cleansed, straightened and wound on reels preparatory to being tinned. After being run through the hot tinning baths, which have a capacity from No. 30 to No. 0000, the wire is cooled and then wound on reels again. After this it is taken to the machines which cover it with the




1. Part of Yard of Factory from Dundee Canal. 2. Stranding Department. 3. Braiding Department. 4. Washing Department. 5. Covering Department.

FIG. 3. THE OKONITE COMPANY'S PLANT AT PASSAIC, N. J.—GENERAL VIEWS.

Okonite compound. As it comes from the final process it is wound on steel reels for curing, and is then sent to the testing department. When the tests are finished the wire goes to the measuring department and is then placed in stock, finished with a plain insulation. It is now ready to ship or to go to the braiding, twisting, cabling or other departments as required. An interesting feature of the covering department is that all the machines are run by electric power supplied by a 30 horse-power "C. & C." motor. This motor has been steadily at work during every hour the plant has been in operation for two years and has never been stopped a minute for repairs. Near it stands an engine for use in emergencies, but it hasn't been called upon to do any work since the motor was installed.

The cable-making machinery in the Okonite plant is especially complete and that for the larger cables is very massive. An immense cable-testing tank is located just below the largest armoring machine, situated on the floor above it, and as the cable comes through the machine it runs down through a hole in the floor into the tank where the tests are made.

This matter of testing is regarded as of the greatest importance by the Okonite company and their testing department is one of the most complete in the whole plant. Not a foot of Okonite wire or cable leaves the factory until it has successfully withstood tests many times as severe as would occur in actual practice. Upon receipt of the wire or cables in the testing department they are at once placed in tanks and kept immersed in water. For standard sizes, the general rule followed is for lamp cord and smaller conductors to immerse for 36 hours. Other sizes with a covering for standing the low-tension test of 1,000 volts remain in for 60 hours. Medium-tension wire, that is a covering which must stand 2,500 volts, must remain in from 60 to 72 hours. Wire made for high-tension purposes, that is to stand the electromotive force of 5,000 volts and over, remains in 72 hours, the same as medium-tension, this time being found to be sufficient for all purposes of saturation. On special sizes or wires for special work tests are made to meet the requirements.

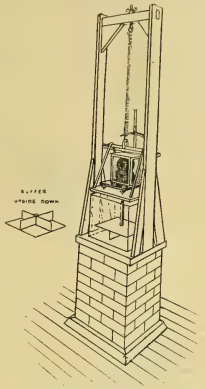



FIG. 6. THE OKONITE COMPANY'S PLANT AT PASSAIC, N. J.—ARRANGEMENT FOR SUSPENDING GALVANOMETER.

Before any electrical tests for resistance are made upon any of these wires an alternating current from an adjustable transformer is applied to all the coils to the tension they are made to stand. If the wires are not strong enough to stand this test, the fault immediately shows up by a little flame, where the insulation is punctured in the water. If the coil stands this test, it is then tested by the usual direct-deflection method on the usual instruments for that test. In some cases, where the lengths are short or in case a specially high D. R. is required, Siemens' loss of charge or some similar test is used.

In case a burn-out occurs in the coil, the loop containing the puncture is immediately pulled out of the water and thoroughly dried on either side. The test is then repeated, and should it stand up O. K., it is then passed on to an expert, who cuts out the puncture. These punctures are naturally more frequent on the low-tension wires than they are on higher tensions, but a coil is never passed until it fully stands all the tests that are put upon it. Very often these coils will stand as many as three or four times what they are expected to, and frequently a coil of low-tension wire stands as high as 8,000 to 10,000 volts.

The testing apparatus differs little from that generally used in all works for the manufacture of insulated wire. Where so many thousand feet are turned out daily quick methods both of testing and working out results have to be used. The instruments are kept at a coefficient of 100,000 each, so that a reciprocal table will show at a glance the absolute resistance, and another table giving the feet expressed in decimals of a mile is used to find the resistance per mile in megohms. These are further simplified by having logarithms of both tables made out, and then all that is necessary is to take the natural number of the sum of the two logarithms to obtain the megohms per mile. A diary is kept, where a reference can be made at a moment's notice, to find the results of any coil tested at any previous date.

1. Rear View of the Factory. 2. Shipping Department. 3 Coiling and Measuring Department. 4. Supply Department. 5. Cabling Department.

FIG. 4. THE OKONITE COMPANY'S PLANT AT PASSAIC, N. J.—GENERAL VIEW.

A stranger, upon entering the majority of testing rooms, will always notice how extremely dark everything is kept, so as to be able to see the spot from the galvanometer. Professor Holman, of the Massachusetts Institute of Technology, introduces an idea by which a testing room could be kept as light as possible. The accompanying drawing, Fig. 5, will show how this idea is carried out at the Okonite factory. The framework holding the scale and lamp is in the form of a triangle and thoroughly enclosed except at the apex, directly opposite the galvanometer, and the base, which holds the scale sliding on a rod for convenience of keeping the zero. An incandescent or oil lamp fitted upon the top of the triangle is shown in the drawing. It will be easily seen that the full light of the beam from the mirror will be received on the ground glass and no outside light can possibly interfere.

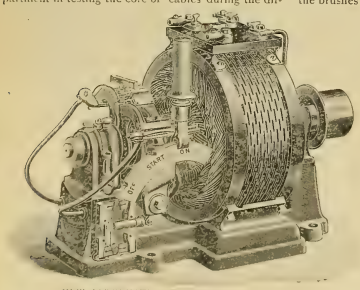
In a building where heavy machinery is used there is bound to be a great deal of vibration, which will affect the delicate suspension of the mirror. A method introduced by the electrician of the Okonite company to prevent this is to add to the usual suspension by a spring a buffer attached to the bottom of the instrument. This buffer rests in a tank of water. The tank could be of any convenient size, and the buffer should be immersed as far as possible, great care being taken that it does not touch the sides of the tank. The addition of a little oil on the top of the water prevents evaporation. The usual suspension by a spring only has the disadvantage of occasionally synchronizing with the steady vibration of the building. This naturally is transformed to the mirror, and the spot, of course, becomes unsteady. The water buffer nearly obviates this. The drawing, Fig. 6, will show in detail how the suspension is rigged up.

Where it is possible to get a spot very steady, it is very often useful to have a very long radius for it, and on one of these instruments the radius is 12 feet, making it possible to get a coefficient with 200 volts and a half a million megohms. This helps to get a more definite result on short pieces of wire for experimental purposes, etc.

Some college professors are very fond of an electrometer, and no doubt this wonderful instrument is very useful in a laboratory, but for all practical purposes a good condenser and a high coefficient galvanometer will answer.

Special attention and care are also given by this department in testing the core of cables during the different processes of manufacture, so that when a cable is finished, either for aerial, underground or submarine work, it is sure to be O. K. for the work it is expected to do.

In going into the details of the testing, it must not be inferred that this is all. The conductivity of all wires is thoroughly tested, and the Wallace high standard is verified before any conductor is insulated.




NEW ALTERNATING CURRENT POWER MOTOR.

## New Alternating Current Power Motor.

The Emerson Electric Manufacturing company, St. Louis, Mo., a pioneer in the manufacture of alternating current fan motors, is now introducing to the trade a line of small alternating current power motors, the ½ horse power size of which is herewith illustrated. These motors are non-synchronous, though practically constant speed, the speed regulation being within five per cent. between "no load" and the rated capacity of the motor. They are said to possess nearly all the features of excellence of a direct current motor, while being superior in that they having no commutator in circuit (except while starting) and call for no attendance at the brushes. They are absolutely protected from lightning, from being placed on the secondary side of the current, and, being arranged for low voltages, they are protected from the burn-outs due to high potentials and broken wires, which are especially troublesome in 500 volt current motors of small size.

No starting box or other device is required in starting the motor, the stopping and starting being effected by a single lever. This lever moves across a sector as shown in the engraving, with three notches marked respectively "Off," "Start" and "On." The lever is allowed to remain in "Start" notch until the motor has attained its normal speed, when it is pushed to "On." In moving to this latter position the brushes are lifted off the commutator, the external current thus having no connection with the amature winding in this position. The switch and fuse terminals are mounted on the motor itself, the only wiring required with these motors being the introduction of the circuit leads into the terminals. The stock sizes of these motors are made by the Emerson company for 16,000 and 7,200 alternations perminute and for 104 volts. Other voltages and frequencies are made to order.

FIG. 2. IMPROVED CONNECTICUT TELEPHONES.

The following are some of the features of merit claimed by the makers for them, the tests having been obtained with ½ horse power motors, and still better results being assured for larger sizes: A starting torque 50 per cent in excess of the running torque; a maximum output of 50 per cent in excess of the rated capacity of the motor; a consumption of energy, running free, of less than 25 per cent of that under full load; an efficiency of from 65 per cent to 80 per cent, according to size and frequency; speed regulation within 5 per cent; a very slight diminution of torque until the speed has fallen more than 25 per cent below normal, thus enabling the motor to take care of a large temporary overload by virtue of its momentum, and to regain its normal speed afterward (the inability to do this is one of the special disadvantages of synchronizing motors); a power factor at full load, of 67 per cent on the 130 cycle circuit and 80 per cent on a 60 cycle circuit for a ½ horse power machine.

These motors are practically noiseless except while starting. They are provided with self-oiling, self-aligning phosphor-bronze journals and a cast steel shaft, the oil boxes being arranged with gauges and cocks, no expense having been spared to make these parts of the motor of the most approved mechanical construction, as indeed they have to be, since the clearance of the armature is a little more than 1-100 of an inch. The Emerson Electric Manufacturing company is putting these machines out under its usual guarantee and is finding a ready demand. It has in preparation sizes from ¼ to 3 horse power and is prepared to make prompt shipment on the ½ and 1 horse power machines of any frequency. Other sizes and a fuller line are promised at an early date.

## Improved Connecticut Telephones.

The accompanying illustrations represents the new telephone of the Connecticut Telephone & Electric company of Meriden, Conn., known as outfit No. 7 (Fig. 1), and the same company's desk telephone (Fig. 2). These instruments are of a high grade of workmanship, and the former, after a series of tests, is claimed to be unsurpassed by any telephone in the market for these excellences: Simplicity in construction (absolutely no adjustment required); impossibility of packing under any conditions; sensitiveness as well as clearness of articulation; least affected by induction of any instrument on the market; indestructibility (will last a lifetime with ordinary care and will be as effective after five years' use as the day they are set up.) The long-distance transmitter arm shown on the instrument illustrated in Fig. 1 will be sold separately to customers desiring it. It is furnished without induction coils unless otherwise ordered.

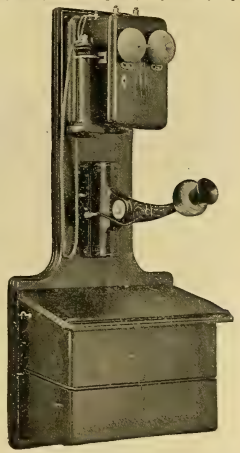


FIG. 1. IMPROVED CONNECTICUT TELEPHONES.

## Crown Woven Wire Brush.

The advantages of using woven wire brushes are known to almost every one having the care of electrical machinery, but one fault has been their liability to spread at the ends, which causes the brush to cover more segments on the commutator than desired, and

CROWN WOVEN WIRE BRUSH.

this trouble, on some machines, causes sparking and heating.

The Crown Woven Wire Brush company, of Salem, Mass., has overcome this fault in its new brush, the Crown "K," which is herewith illustrated. This brush is made with a core of very fine braided wire placed diagonally in the center with a covering of just as fine cloth, woven after the manner of lace, giving more ventilation than in ordinary weaving; it is then sewed firmly together with strong thread, which prevents it spreading at the ends.

This brush differs entirely from other American made brushes, and is somewhat similar to the imported German brush and, owing to the duty on the imported, they are sold at a lower price. This company also makes the ordinary woven wire brush. Its sales are rapidly increasing, and its goods are used all over the United States and in many foreign countries.

## PERSONAL.

Rollin B. Trouslot, manager of the Colorado Electrical Supply company of Colorado Springs, Colo., is spending a few days in Chicago.

Clarence B. Stump, well known in street railway and electrical fields, has been appointed general manager of the Electrical Exposition, which is to be held in New York city, commencing May 4th, and continuing until the first of June.

Alfred Ely Beach, editor of the *Scientific American*, died at his home in New York on January 2d. Mr. Beach was born in Springfield, Mass., in 1826. He was the son of Moses Y. Beach. When he was 20 years old he formed a partnership with Orson D. Munn, and they became the proprietors of the *Scientific American*, which was at that time the only weekly journal of its kind in the country. During nearly fifty years Mr. Beach was active in the editorship of the *Scientific American* and in the direction of the extensive patent business of the firm. He had a faculty for mechanics and all branches of science.

## TRADE NEWS.

Dr. W. P. Freeman, of New York, has removed his office from the Electrical Exchange building, to room 2, 106 and 108 Liberty street, where arrangements will be made for an experimental room and laboratory.

The Brady mast-arm for electric street lights has a wide reputation. It is said that over 20,000 are in use. This device is made by T. H. Brady, 351 Main street, New Britain, Conn., who also manufactures brackets, hanger-boards, cut-out boxes, lamp pulleys, street hoods, spark arresters, etc.

It will without doubt be somewhat of a surprise to the electrical trade in general to learn that the Metropolitan Electric company of Chicago sells its catalogues. The trade is already familiar with the remarkable piece of catalogue work which the Metropolitan company has just issued, and the fact that it is in such demand that it can be sold rather than given away is indicative of the electrical trade's appreciation of the Metropolitan company's enterprise. To quote President Wm. McKinlock's own words, "It is a departure in one sense, to be sure, but those who have purchased this book tell me that we are perfectly justified in selling it, as it is a veritable encyclopedia of its kind and well worth the small consideration asked for it."

There are probably few articles manufactured which require more delicacy of finish and perfect construction than the telephone; and it is gratifying to hear such good reports regarding the output of the Connecticut Telephone & Electric company of Meriden, Conn. Letters testifying to the good work performed by these instruments have been received from the Globe Bros. Hardware company, of Cohoes, N. Y., Rudolph Schmidt & Co., Rochester, N. Y.; the People's Telephone company, Bowling Green, O., and from T. J. Campbell, of Hartford, Conn., who was enthusiastic over the results obtained, stating that of the many telephones which he had installed, this was the first one that did its work in a satisfactory manner, four being placed on a line of six miles on trolley poles, with bare No. 12 copper wire, and having no induction when in use.

## BUSINESS.

The Weber Gas and Gasoline Engine company, Kansas City, Mo., is well booked with orders for gas engines at this time, and is running its entire force 24½ hours overtime. The company further states that the outlook for future business is very bright.

The enormous business of the Fiberite company, manufacturer of the Medbery overhead material, demonstrates the confidence with which the public recognizes the superiority of this equipment. When the highest class of material is desired, the company is almost without a competitor. No other material, it is claimed, is sold under such a strong guarantee. Already large orders have been received for the new spring business, while several orders have been received from roads where it is necessary to re-equip. Naturally such a system calls for the best possible material. The Mason Electric Equipment company, Chicago, the selling agent for the company, carries a large stock in its storerooms ready for immediate delivery.

The Electric Appliance company finds the new year opening very satisfactorily. Increased perseverance and push it has collected a line of first-class agencies, which includes bare copper wire, "O. K." weatherproof wire, Packard lamps and converters and Upton arc lamps. In fact a central station man can step into the store at 242 Jackson street, Chicago, and place his entire order for central station equipment, outside of his apparatus. The company is also receiving congratulations on its recent appointment as general western sales agent for the Taunton Copper Manufacturing company, Taunton, Mass., one of the oldest and largest manufacturers of copper wire in the country. It is in a position to ship any order for bare copper wire promptly from the factory.

The chain saw mortisers and Case steam engines made by the New Britain Machine company of New Britain, Conn., are described in a recent pamphlet. The sole agent for the sale of these machines is Sidney B. Whiteside, 139 Liberty street, New York. All correspondence should be addressed to him.

The Beardsley Manufacturing company, 234 Lake street, Chicago, is now offering a line of goods of interest to electrical manufacturers and supply dealers. It is now manufacturing the Ajax brand of oiled paper which is used by a large number of electrical manufacturers for insulating fields and armatures of dynamos and motors. This specialty particularly has met with a most encouraging demand, and Mr. Hines states that there has not been a single complaint as to the quality of this paper. The company also has excellent facilities for turning out brass, copper and aluminum goods. It has, too, for several years been making commutator bars and brass and copper connections. Another branch of the business that is steadily growing is the manufacture of yellow brass gas and electric light fixture goods. The company also works a finishing electroplating plant and is preparing to handle any class of finishing work in a satisfactory manner. The controlling interest of this concern was recently secured by Lucius A. Hine, the present manager of the company, and with his energetic efforts the business is rapidly increasing.

In central stations and railway power stations using Thomson recording wattmeters to measure the total output from each machine, or upon each feeder, the grouping of the dials of all the meters in one place where they can be conveniently read at one time has been frequently urged as advantageous. The General Electric company has therefore brought out a telltale dial system. This permits the placing of all the dials upon one panel and the installation of the meters out of ordinary reach, as it is no longer necessary to read them each day. The necessary wiring from the meters to the panel is simple and inexpensive. The panels can be duplicated and the performance of the meters can be read either in the dynamo room or in the manager's office, or any other necessary place, and the performance of the station can be accurately learned at any time. Each row of dials on the panel represents a single generator or feeder, and the recording instrument is actuated by a kilowatt-hour by a simple make-and-break device upon the meter, securing its circuit. The dials are several times larger than those on the ordinary meter and they are all direct reading, all constants being eliminated by modifications of the actuating mechanism. It is only necessary, in ordering the telltale dial, to state the constant of each meter and the character of the generator; the panel can then be properly lettered.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued December 31, 1895.*

552,094. Automatic Electric Switch. Harry H. Blades, Detroit, Mich. Application filed September 14, 1895.

The combination with an electric motor, of a switch governing the admission of current to the motor, a solenoid electro magnet on an independent shunt circuit, the solenoid having a revolving armature adapted to engage and hold in magnetic clutch an iron flange attached to a switch-lever, a series of resistances arranged to successively make contact with the switch-lever, and means for automatically retracting the switch-lever to its initial position when the magnet is de-energized by the cessation of the current.

552,103. Multipolar Electromagnet. William P. Daniels, Cologne, Germany. Application filed September 7, 1895. Patented in Germany July 11, 1895.

In a lifting magnet, the combination with an electromagnet, of a plurality of pole pieces therefor, and a yieldingly adjustable end piece or extension for each of the pole pieces adapted to engage the object to be lifted, whereby the pole pieces of the lifting magnet may adjust themselves to variously shaped objects to be lifted.

552,105. Apparatus for Automatically Maintaining Current Upon Moving Vehicles. Harry E. Dey, Brooklyn, N. Y. Application filed May 20, 1895.

The combination with a vehicle, of an electric motor embraced in a circuit energized from a source of supply, a motor-dynamo or similar converting device, and a storage battery energized from the motor-dynamo and adapted to actuate the latter and energize the motor circuit upon a cessation of the main supply.

552,153. Keyless Fire Alarm Telegraph Box. Nathan H. Suren, New York, N. Y. Application filed March 8, 1895.

In a keyless fire alarm signal box, the combination with the operating handle of a spring mechanism which is wound up by the movement of the handle, a trip releasing a spring mechanism from the handle after a definite movement of the handle, and an alarm bell operated by the spring movement after it is released from the operating handle.

552,166. Electric Thermostat and Push-Button. Orator F. Woodward, Le Roy, N. Y. Application filed December 20, 1893.

The combination of a base with an expansible strip, a movable conducting bar, and an electrode, all supported on the base in a plane parallel thereto, the expansible strip and conducting bar being parallel to each other and connected at the tree end of the former and the electrode being arranged opposite the other end of the bar for closing the circuit when the strip expands.

552,172. Electro-magnetic Mechanism. Stephen D. Field, Stockbridge, Mass. Application filed August 5, 1895.

In a system of compensating levers, a pair of levers arranged substantially parallel and having abutting faces, one of the faces being curved and a support for one of the levers adapted to permit longitudinal movement thereof.

552,173. Electric Telephone. Stephen D. Field, Stockbridge, Mass. Application filed August 5, 1895.

The combination with a diaphragm and a device adapted to vibrate therewith, of a system of compensating levers interposed between the diaphragm and the device and adapted to alter the relative vibrations of large amplitude and those of small amplitude.

552,181. Electrical Railway Signaling Apparatus. Henry J. Hovey, Evanston, Ill. Application filed August 5, 1895.

The combination with two track circuits, each having an electro-magnet therein provided with an armature, of a contact arranged adjacent to the armatures and adapted to form contact therewith, the armatures having flexible portions arranged in the line of movement of each other, whereby one may hold the other away from the contact, and a signal circuit having one limb connected with the contact and the other limb with the armatures.

552,190. Electric Arc Light. Louis B. Marks, New York, N. Y. Application filed October 9, 1894.

An arc lamp having a transparent or translucent inclosure around the arc, provided with a small inlet for air and ducts for leading the air in a uniform direction relatively to the arc.

552,211. Depolarizer for Primary Batteries and Method of Making Same. Gustave W. Thurnauer, Aurora, and Milton M. Kohn, Chicago, Ill. Application filed February 20, 1895.

A depolarizing plate for batteries consisting of copper oxide, and a bonding material capable of being reduced by gas liberated by the action of the battery, the whole being formed into a solid mass.

552,218. Electric Battery. David S. Williams, Philadelphia, Pa. Application filed July 19, 1895.

A supporting device for a sectional cathode, comprising a number of superposed receptacles connected together horizontally and forming a continuous yielding conductor, the receptacles being in electrical contact above and below with all the sections of the cathode.

552,216. Electrical Battery. David S. Williams, Philadelphia, Pa. Application filed Aug. 23, 1895.

An improved battery comprising essentially a casing of electrical conductive material, containing an electrolyte, the inner surface of the casing being of non-conductive material, a series of cathodes secured to opposite sides of the casing and in contact with the conductive portion of the casing, and an anode between the cathodes of opposite sides of the casing.

552,220. Electric Battery. David S. Williams, Philadelphia, Pa. Application filed August 23, 1895.

An electric battery comprising an outer shell or casing, a series of partitions inactive to the electrolyte dividing the same into a number of chambers, a studd of conducting material in the partitions, a negative electrode carried by one end of the stud within one chamber, and a positive electrode carried by the opposite end of the stud within an adjoining chamber.

552,230. Safety Device for Electric Circuits. Paul H. D'Unger, Chicago, Ill. Application filed September 16, 1895.

In combination with an electric circuit, a switch included therein, an inductive coil whose primary includes a portion of the circuit, a body of explosive material connected with the switch, and the secondary circuit of the coil, having its terminals in the explosive and adjacent thereto.

552,260. Apparatus for Transforming Alternating Currents Into Unidirectional Currents. Carl Pollak, Frankfort-on-the-Main, Germany. Application filed May 22, 1893. Patented in France October 28, 1892, in England November 2, 1892; in Switzerland May 26, 1893; in Austria, April 3, 1894, and in Hungary April 3, 1894.

The combination with an alternating current machine, a straight commutator, and a circuit between them, of a current straightening commutator having insulable segments and brushes interposed in the circuit, the commutator being constructed so as to hold the electrical connection between the commutator segments and the commutator brushes open while the current impulses are below a predetermined potential but higher than zero, and closed while the impulses are above such potential.

552,271. Electrical Bicycle. Ogden Bolton, Jr., Canton, Ohio. Application filed September 19, 1895.

A hollow shaft with rods insulated therein, and having the wires connected thereto, the field magnet secured to the

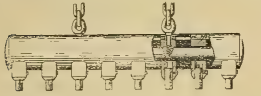
shaft, the supporting plates carrying a portion of the ball bearings, and provided at their inner edges with a hub for the commutator; and an inclosing ring secured to the outer ends of the supporting plates, combined with the armature, the castings applied to its opposite ends, the spokes, and the pneumatic tire.

552,279. Electric Signal for Railways. Elisha B. Cutten, New York, N. Y. Application filed April 1, 1891.

A railway track, one rail of which is divided by insulations into conducting sections or blocks, resistance bridges introduced between the insulated sections and the opposite rail, two contact rails at each signalling-point, an electric connection between one of the rails and the insulated rail of the block next in advance, and a line wire constituting an electrical connection between the other of the rails and the second section or block in advance.

552,309. Electric Meter. John R. Tucker and Charles C. Hinckley, Aurora, Ill. Application filed March 25, 1895.

In an electric meter the combination of a register with a device responsive to the main current, a vibratory arm adapted by its movement to actuate said register, and an interrupter located between the vibratory arm and the register and adapted to interrupt the operation of the register at intervals.



NO. 552,103.

552,313. Synchronous Single-phase Motor. Charles E. L. Brown, Baden, Switzerland. Application filed February 6, 1893.

In an electric motor, the combination, with a stationary winding, of a rotating winding, two collectors each connected directly with the rotating winding, and of which one is a multiple-part collector and the other a few-part collector, having as many parts as the machine has poles, the first collector being adapted to be thrown out of action when starting the motor, whereas the second collector serves to act only when synchronism is reached, a pair of brushes in contact with each collector, and proper electrical connections for said brushes.

552,316. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Application filed July 10, 1894.

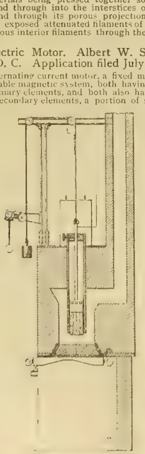
In an electrical railway signaling system, the combination, with an insulated block or section of track, and an electrically controlled signal controlling the entrance of trains to the block at one end thereof, of a battery at the distant end of the block and a signal circuit therefor passing through the rails of the section of track and controlling the signal at ths home end of the block, the battery being normally out of track circuit and a circuit controller operated from the home end of the block, and arranged, when operated, to throw the battery into the signal circuit.

552,322. Secondary Battery. Alvaro S. Krotz and Wilbur W. Spencer, Springfield, Ohio. Application filed January 31, 1895.

A storage or secondary battery plate, consisting of a conductor, a quantity of active material, and sheets of porous holding material having interior porous projections, the latter materials being pressed together so that one fills through and through into the interstices of the other and through and through its porous projections, to form innumerable exposed attenuated filaments of active material and numerous interior filaments through the porous projection.

552,337. Electric Motor. Albert W. Smith, Washington, D. C. Application filed July 23, 1895.

In an alternating current motor, a fixed magnetic system and a movable magnetic system, both having circularly arranged primary elements, and both also having circularly arranged secondary elements, a portion of said total num-



NO. 552,341.

ber of [illegible] switchable, and a commutator for [illegible] elements in effect [illegible] torque [illegible] with the non commutable element.

552,338. Electrical Rail-fish. Victor Thélin, Geneva, Switzerland. Application filed August 1, 1895.

The combination with rails having holes through them near their ends, of tubular plugs to pass through and project beyond the surfaces of the rails and open at both ends, and each having a projecting block and a rod extending from one block to the other, and a taper pin driven through each tubular plug adjacent to the block to press the block against the rail and spread the plug and prevent the same being withdrawn.

552,341. Electric Smelting Furnace. Joseph A. Vincent and James E. Hewes, Philadelphia, Pa. Application filed July 18, 1895.

In an electric smelting furnace, the combination of the hearth, with a removal bottom constituting one of the electrodes, an adjustable electrode arranged above the bottom and movable vertically, and feeding devices at the upper part of the hearth or furnace for delivering the materials to be smelted into the hearth.

552,347. Motor Suspension for Street Cars. George F. Card, Mansfield, Ohio. Application filed August 21, 1895.

The combination, with a motor, of a frame having one end elastically supported upon the car truck, and the other end elastically supported from the car axle, and a pivotal connection of the motor and frame between the points of support of the frame.

552,363. Insulating Joint. Elliott P. Gleason, Brooklyn, N. Y. Application filed December 27, 1894.

In an insulating coupling the combination of two tubular and flanged portions, the faces of the flanged portions being at substantially right angles to the length of the tubular portions, a fastening device, consisting of a ring on the outside of the flanges and covering them and the plugs, the insulating material and plugs of insulating material extended through holes in the flanges.

552,369. Means for Operating Electric Railway Vehicles. Ernst G. W. C. Hoffmann, Charlottenburg, Germany. Application filed September 3, 1895. Patented in Italy April 8, 1895; in England May 5, 2895; and in France June 20, 1895.

An electric railway vehicle having a rotative bar or shaft adapted for operating current controlling resistance devices and motor current reversing devices, one or both, and provided with a longitudinal slot, combined with a coupling device having studs adapted to the slots of the rotative bars or shafts of two vehicles.

552,384. Electric Gas Lighter. Philip Meyer, Alameda, Cal. Application filed September 20, 1895.

In combination with an atmospheric or Bunsen burner, having its surface of ignition enveloped by a mantle adapted to be rendered incandescent under heat, electrodes centrally disposed upon the ignition surface and suitable electrical connections for the electrodes.

552,397. Regulator for Dynamos. Charles E. Scribner, Chicago, Ill. Application filed June 1, 1889.

In a dynamo-electric machine provided with consequent pole pieces, the combination with symmetrically disposed sectionally wound field magnet coils, of means for altering the circuit connections of the sections of the coils to vary the relative magnetizing power of the coils, thereby rotating the entire field of force through the armature about the axis of the armature in a plane perpendicular to the axis, whereby the diameter of maximum commutation is shifted to vary the voltage of the machine.

552,413. Apparatus for Purifying Water by Galvanic Action. Samuel G. Cabell, Washington, D. C. Application filed February 15, 1895.

In an apparatus for purifying water by galvanic action, the combination of the vertical casing having ports near its bottom and top, a horizontal grating arranged above the lower port, and a series of vertical positive and negative plates, arranged on the grating and spaced apart to afford water passages.

552,414. Galvanic Feed-water Purifier. Samuel G. Cabell, Washington, D. C. Application filed October 16, 1895.

In a feed-water purifier, the combination of a gland having a separate chamber for impurities, a galvanic pile within the gland, a supplementary battery electrically connected with the pile, means for forcing water through the gland to the boiler, and a return connection for conveying hot water from the boiler to the gland.

552,425. Secondary Battery. Camille A. Faure, Paris, France, and Frank King, London, England. Application filed March 6, 1895.

In a secondary battery, the combination with the conducting support carrying the active material, of a sheet or layer of silicated asbestos fabric, and a perforated envelope or cover of acid-resisting material, such as ebonite or celluloid, which is kept from contact with the active material by the silicated asbestos.

552,445. Combined Pavement and Subway System. Charles H. Platt, New York, N. Y. Application filed July 27, 1894.

A combined pavement and subway constructed of previously formed sectional blocks, each section being formed with a semicircular longitudinally extending recess or opening and oppositely extending shelving projections respectively flush with the opposite faces of the block section, the block sections are joined together in upper and lower layers forming continuous subways of circular cross section and with the shelving projections interlocking.

552,451. Electric Railway. Michael H. Smith, Halifax, England. Application filed October 26, 1887. Patented in England December 28, 1886, and in Belgium June 13, 1887.

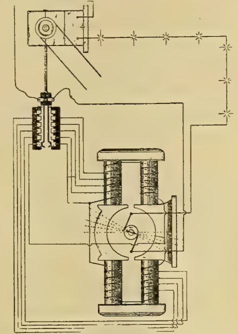
In an electric railway system the combination with the main conductor, of sectional surface bar conductors having extended pole pieces, and a magnetic switch comprising a pivoted lever carrying an armature for the pole pieces and carrying a contact piece for the main conductor.

552,469. Double Diaphragm Telephone Transmitter. Daniel Drawbaugh, Eberly's Mill, Pa. Application filed February 23, 1895.

In a microphone transmitter in which two or more diaphragms constituting a double or multiple diaphragm are arranged in a vocalizing chamber, the combination with the diaphragm carrying carbon buttons, of an interposed insulating disk, a spongiform annulus in which the buttons fit, and a body of granular carbon between the buttons.

552,477. Rail-bond for Electric Railways. Budd J. Jones, Chicago, Ill. Application filed March 29, 1895.

A rail bond for electric railways, comprising rails and fish plates in combination with a pair of looped U-shaped bond members, having lateral rivet studs on their respective ends, the one bond member having a greater spread than the other in order to bring the rivet studs thereof out of line with the other member, such bond members being arranged on opposite sides of the rail webs, and between the same and the fish plates.



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552,479. Electrical Rail-bond. Minott K. Kendall, Melrose, Mass. Application filed August 12, 1895.

An electrical bond for railway rails, comprising in its construction a strip of conductor metal provided with cross slits which form points or projections adapted to be forced into a bolt hole in the web of the rail, and tightly wedged therein by the bolt.

552,490. Wire Stripping Tool. Adelbert O. Benecke, Newark, N. J. Application filed January 10, 1895.

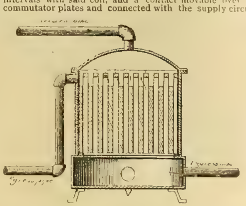
An instrument for cutting through the insulation upon insulated electric wires, consisting of a pair of hinged members, one of which carries a roller, of varying diameter, at its outer end, the axis of the roller being at right angles to the longitudinal dimensions of the member, and the other of which carries a knife in line with the smallest portion of the roller, the plane of the knife being at right angles to the axis of the roller, the members being so joined together as to leave a space for the wire to lie along the whole length of the tool between the members.

552,495. Regulator for Electrical Circuits. Joseph C. Mayrhofer, New York, N. Y. Application filed July 5, 1895.

The combination with a resistance coil, of a series of commutator plates connected at intervals with the coil, circuit connections from the opposite ends of the coil independent of the commutator, and two contacts having circuit connections movable over the commutator, whereby different circuits may be regulated independently or together in the same or opposite directions.

552,496. Electric Lighting System. Joseph C. Mayrhofer, New York, N. Y. Application filed July 5, 1895.

In a theater light regulator, the combination with a resistance coil, a series of commutator plates connected at intervals with said coil, and a contact movable over the commutator plates and connected with the supply circuit,



NO. 552,413.

of two or more lighting circuits, and an independent switch for one side of each lighting circuit having connections with both ends of the resistance coil whereby the lighting circuits may at the same time be connected with the same end or with different ends of the resistance coil, the other sides of the lighting circuits being connected with the supply circuit.

552,498. Electric Arc Incandescent Lamp. John A. Mosher, Chicago, Ill. Application filed September 23, 1895.

In a composite carbon for electric arc lamps all portions of which are combustible and electrically conductive, the combination with a core, of a body portion superimposed thereon and being, relatively as to the core, of high combustibility and low electric resistance.

552,501. Insulator. Charles H. Snively, Mount Carmel, Pa. Application filed March 20, 1895.

The combination with suitably supported insulator blocks of means for simultaneously clamping the wire between the blocks and stretching the wire.

Western Electrician.

EVERY SATURDAY.

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## Electrical Features of the Bicycle Show.

The bicycle exhibition held last week at Tattersall's, in Chicago, was a great success. Every available foot of space in the great building, and also in a two-story annex extending to State street, was filled with exhibits. About 1,600 wheels were shown by the 300 exhibitors, as well as accessories, parts, bicycle clothing, bicycle-making machinery and novelties of all sorts. That large portion of the public interested in cycling took a great interest in the display, and it is estimated that 80,000 persons paid admission to see the show during the week. The display was made under the auspices of the National Cycle Exhibition company of Chicago—a corporation organized by the representatives of the bicycle press in Chicago. The expenses were heavy, but the company will clear up a handsome profit, even after turning over 50 per cent. of the proceeds to the Cycle Board of Trade, as it was compelled to do.

A very liberal use of electricity was made for general illumination, decorative purposes and for operating small motors. Tattersall's is supplied with an isolated plant, consisting of a 35 light Thomson-Houston arc machine and a 20 kilowatt Edison 110 volt dynamo, driven by an Armington & Sims engine. There is also a high-tension arc light circuit and a limited low-tension current supply from the Chicago Edison company's mains. These sources of current were entirely inadequate, however, for the heavy demand of the week, and temporary arrangements to supply the needful current were hurriedly made.

In the basement the arc machine was disconnected from the engine, and its place was taken by a bipolar Mayo 110 volt dynamo. The engine, rated at 100 horse power, was then speeded up to its highest capacity at the 80 pounds steam pressure from the boiler in the building. The Edison dynamo remained connected as usual, and the two 110 volt machines thus provided were driven at their maximum capacity, giving about 500 amperes—150 from the Edison machine, running up as high as 176, and 350 from the Mayo dynamo, reaching a maximum of 370. These generators were wired in multiple and supplied current to 1,187 16 candle power incandescent lamps in the booths lining the four outer walls of the great building. The output was controlled from a temporary switchboard. A view of this hard-working equipment is given in Fig. 2.

FIG. 1. ELECTRICAL FEATURES OF THE BICYCLE SHOW.—A FEW OF THE LAMP SIGNS.

In addition there was an entirely independent and greatly increased supply from the South Side station of the Chicago Edison company. This comprised about 1,100 amperes of low-tension current and the operation of 64 high-tension 2,000 candle power arc lamps. The latter feature presented no especial difficulty, as an arc circuit, operated from a Wood dynamo at the station, was already in the building. To get the great amount of 110 volt current required, however, from the station at Twenty-seventh street, two miles away, required unusual and rather elaborate preparations. To meet the emergency two 100 kilowatt Edison bipolar machines, usually operated at 115 to 120 volts, were cut out of the general service plant at the station and separately driven to a speed of 850 revolutions per minute. The output at the brushes had a pressure of 200 volts, and the machines were connected to the mains of a three-wire feeder line. The underground system in the alley east of State street was utilized for transmission to Sixteenth street. A special system of feeders on this street, including one main laid especially for the purpose, took the current two blocks west to the building, where the current was used at from 105 to 120 volts, the difference from the original potential of 200 volts representing the drop in the two-mile transmission. About 1,100 amperes of current was thus sent into the building. It supplied some 2,000 incandescent lamps of 16 candle power, or their equivalent, and 30 low tension arc lamps. This current was used in the exhibits in the central portion of Tattersall's and in the annex. The feeder circuit was entirely independent of the local plant and brought in at another part of the building.

In all, the current used during the week supplied the equivalent of 4,000 16 candle power lamps and cost the Exhibition company about $4,500, including the special construction work. Quite a number of small motors were employed to operate stationary bicycles or moving sign devices.

The work was all quickly done. Erikson & Smith, who did the general interior wiring for the exhibits, performed their work practically in two days. It was no trifling undertaking, as will be understood when it is stated that three cables, each 245 feet long and of 500,000 circular mils section, were used to take the current

from the point where the Edison feeders entered the building to the center of distribution for the central exhibits. The large amount of wire used was furnished by the New York Insulated Wire company through James Wolff, the Chicago agent. The three-wire system was used for the central portion, on the Edison station, while ordinary two-wire circuits supplied the outside booths, from the basement plant. The entire independence of the two systems insured the building against darkness in the event of a possible breakdown.

Much of the current consumed supplied signs made up with incandescent lamps. Many of these were striking and artistic, and a few of the more prominent are illustrated in Fig. 1. The Stearns column was conspicuously placed and was effective with ground glass lamps on a background of dead black. It was made for E. C. Stearns & Co. by the Allen-Hussey company of Chicago, which did much of the sign wiring. The Columbia sign was dainty in miniature red lamps on black letters and scroll-work on a background of red. The Barnes sign was a revolving affair, driven by a motor, while the crescent (emblematic of the Crescent wheel) of the Western Wheel Works was bold and attractive. The *Outing* and Smalley signs also attracted much attention. The signs of *Bearings*, the Sterling Cycle Works and the Liberty Cycle company are worthy of mention, but are not shown in the picture.

Of the exhibits only two were electrical, and these were bicycle lamps. The Cycle Electric Light company of Chicago attracted much attention with its compact primary battery and miniature lamp for bicycle use. The outfit weighs two pounds, and the light, intensified by a lens, is said to be of 18 candle power. On one charge of the battery it is said that the lamp will burn 10 hours. The battery is said not to leak over one per cent. on open circuit, and the life of the lamp is placed at 300 hours. A somewhat similar lamp, supplied from a primary battery, was shown by the Eclipse Bicycle company of Boston. The material used in making the solution for this battery is sold in the shape of a dry powder known as "Eclipse electric sand."

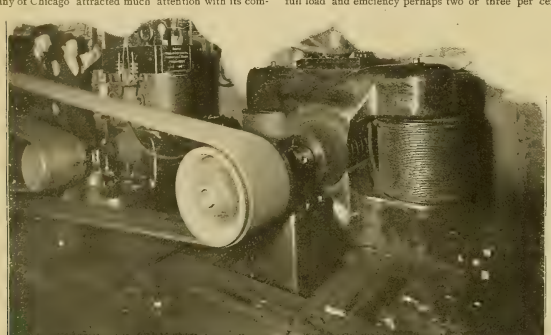



FIG. 2. ELECTRICAL FEATURES OF THE BICYCLE SHOW.—DYNAMOS OF TEMPORARY BASEMENT PLANT.

## Chicago Electrical Association.

The Chicago Electrical association held its third meeting for this season at 1737 Monadnock building January 30. The paper of the evening was by W. Clyde Jones on the "Protection of an Invention" and was a concise and complete statement of facts regarding American patent laws and customs. The paper was discussed by W. B. Gerson, Thomas G. Greer, S. B. Jamieson and others. Following the reading of the paper the election of officers for the coming year was held and resulted in the election of W. Clyde Jones president, S. G. McMeen, vice-president; J. R. Cravath, secretary; F. S. Hickel, treasurer. There has recently been a great increase in interest and membership of the association, which promises to take a prominent place among the local societies in the largest cities of the country. Electrical men [illegible] are cordially invited to attend.

It is probable that the Columbus and Metropolitan Street Railway companies of Washington, D. C., will be consolidated.

## Selecting an Electric Motor.

By Dr. G. H. Zahn.

*The Rating of Motors.*—The proper selection of an electric motor is not so easy as is generally supposed. The difficulty is due not to a lack of suitable motors, but rather to the imperfect manner of rating electrical machinery.

A steam engine is not sold by the horse power, for an engine developing 50 horse power at one-fifth cut-off could furnish about 100 horse power at two-fifths cut-off; it is rated by the diameter of the cylinder, the length of stroke and the speed. If boiler pressure and ratio of expansion are also taken into consideration, it is easy to select from the manufacturer's list an engine most suitable for the work to be performed.

Electric motors cannot be rated the same way, for the size of the armature and the speed do not give any means of rating the power developed by the machine. The load of an electric motor is limited only by two conditions:

First—When the motor is loaded to such a degree that the heating of the windings may injure and destroy the machine.

Second—The load limit is also reached when the motor sparks so badly that the commutator is in danger of being destroyed.

In buying a motor the customer, if he is no expert, depends entirely on the guarantee of the manufacturer, and generally the machine is preferred which shows at full load and efficiency perhaps two or three per cent. higher than the one of other makers. The fact that (by the general customer) too much attention is paid to the full load efficiency of an electric motor, and none, or not enough, to the kind of work and the conditions under which the machine is being operated, results quite often in the disappointment of the purchaser. The conditions under which a motor is running affect the design of the machine very much, and there are two distinct classes. The first class comprises the commercial motors used for running machinery by belt. Various tests made in regard to the work done by this kind of motors show that the average power demanded is below 50 per cent. of the horse power stamped on the name-plate of the machine. The motors of the other class are used for operating street cars, cranes, or doing other heavy intermittent work.

A motor of the first kind mentioned, say of an output of 10 horse power, should therefore have a very high efficiency at light loads, three horse power and above, and be able to furnish 10 horse power all the day long without sparking and undue heating, while a so-called 10 horse power motor of the other class should develop even from 30 to 40 horse power for periods of about 20 minutes without sparking and injury to the machine.

Now, if two 10 horse power motors, both being of the same design and, generally, built for a high efficiency at full load and guaranteed to develop 20 per cent. power above the normal output, without undue heating and sparking, are supplied to work under the two different conditions mentioned above, the manufacturer will hear, perhaps, from one customer—using the motor to run a printing press—that the efficiency of the machine is too low at one third load while the other customer—operating a crane by the motor—will say that the motor is not a good machine, for it sparks too much at an overload of 300 per cent.

Thus it is easily seen that a manufacturer can hardly fill the requirements of these two distinctly different cases by supplying machines of the same design.

The efficiency curves of the two kinds of motors are represented in the accompanying cut, *A* being the curve of a commercial motor. It is expected to run at one-half or two-thirds load average, and the efficiency, therefore, should be high for these loads. *B* shows the curve of the motor of the other class. The efficiency is very low at light loads, while it is exactly the same for full load as in *A*, and at an overload even higher than that of the former.

This difference of the efficiency curves may be obtained by a slight modification in the design of the two motors—by the different distribution of the losses of both machines. The losses in a dynamo or motor are due to field current, hysteresis, eddy currents, brush and bearing friction, resistance of armature winding and commutation. Motor *A* is a machine using comparatively few lines of force; therefore the amount of copper wire on the magnets is very small and not much current is required to excite the field. The losses due to hysteresis and eddy currents are low, only a small quantity of iron being used in the armature core; the bearings are rather light, thus reducing the friction, for this motor is never called upon for more than normal load. The losses due to armature resistance and commutation may be high without affecting very much the efficiency at light loads.

In designing a motor of the type *B* just the reverse of the former conditions has to be effected. The motor is supposed to run for some time with a considerable overload, which causes a heavy current to flow through the armature conductors. The armature windings have to be of a larger size than in *A* to prevent heating, and the loss due to resistance is rather small. More iron is used in building up the armature core; the greater current, when the machine is running at an overload, causes a greater armature reaction, and in order to prevent sparking a stronger magnetic field and more lines of force have to be produced. This results in larger magnets and increases the weight of copper wire, so that more current is required to excite the field. Finally, the friction is much increased by the use of larger bearings.

As far as the development of power is concerned it is easily seen that motor *B* is far superior to *A*; it can run at three times its rated load, while motor *A* never will be called upon for more than its rated capacity, and generally is running much below its normal load.

Of great importance in relation to the rating and the price of a motor is its speed. How far the output of a machine is affected by its speed may be seen by the following: If the pattern of a 10 horse power motor running at 1,200 revolutions per minute shall be used to properly build a motor running at 600 revolutions per minute, it will be found that the output of the slow-speed machine is about 4½ or five horse power. The weight and cost of manufacture are about the same for both motors. This explains the higher price of slow-speed machines.

Therefore, in rating and comparing electric motors, the following points have to be carefully considered:

At what load does it commence to spark?

At what load does the temperature rise abnormally?[1]

What is the efficiency at different loads?

At what speed does it run?

These four points, considered together, give a fair way of rating and comparing motors.

*Generators as Motors.*—It is generally known that a good generator will give good results if used as a motor. This holds good if the machine be running under suitable conditions, as considered above; *i. e.*, if it be chosen with a view to the kind of work to be performed and its efficiency at different portions of the load. But if a lighting dynamo is used as a motor its available brake horse power will be some 30 per cent. less than the belt horse power to run it as a generator, and the speed will be about 10 per cent. less than that given for the dynamo.

The nature and conditions of the work the motors have to do are so various that they cannot be standardized in the same way that the lighting dynamos can. There are three classes of lighting dynamos, according to the winding of the magnets, the series, shunt and

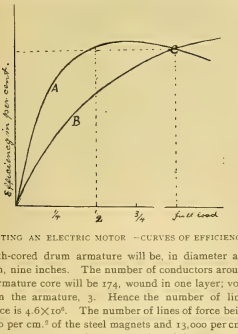
[1] Correct results in determining the increase of temperature of a dynamo cannot be obtained by using a thermometer, the proper way is to measure the resistance of the armature winding and magnet wire before and after running the machine. A five to six hours run is sufficient using the increase of resistance measured for determining the increase of the temperature.

compound wound machines. But there are many ways of winding the field magnets of motors, each adapted to a particular purpose. A fairly good idea of these various windings may be gathered from the following table (Crompton):

| Nature of Winding of Field Magnets. | | | Speed Regulation. | Starting Power. | Remarks. |
|---|---|---|---|---|---|
| Generator. | No. | Motor. | | | |
| Series. | 1 | Series. | Good. | Good. | Sometimes used for moderate sized installations where only a single motor and generator, the latter doing no other work are used, and with a moderate loss in the line. Series motors with governors are sometimes used on series arc light circuits. |
| Compound, or any other supply of constant E. M. F. | 2 | Shunt. | Good. | Fair. | Shunt wound motors are very largely used on the mains of supply companies taking current at constant electromotive force, also in workshops, where lighting dynamos are used, etc. |
| " | 1 | Series. | Bad. | Very Good. | Sometimes used for driving pumps and similar work where the load is quite steady. If there is any possibility of the load being removed (by belt coming off), then a speed governor must be attached to cut off the motor, or it may run at a dangerous speed. Chiefly used for small motors of high electromotive force, for if such motors are shunt wound, the shunt wire is very small and easily broken. |
| " | 4 | Differential. | Very Good. | Fair. | Used only where exact speed regulation is required. The regulation in case No. 2 is close enough for most purposes. |
| " | 5 | Special Compound. | Fair. | Good. | A compromise between Nos. 2 and 3. Used where great starting power is required, capstans, hoists, etc. |

has nothing to do with the conditions under which the motor is working or with its efficiency. Both types can be built for the same efficiency, and if properly selected, that is, according to the kind of work to be done, one machine will do the work as well as the other. The multipolar dynamos and motors have been the fad of late years, and some manufacturers even built one-fourth or one-half horse power motors of the multipolar type. Small multipolar machines do not have any advantage over bipolars, and there is no doubt that in a short time more bipolar dynamos and motors will be on the market. The bipolar motor is a far simpler machine than the multipolar, as generally built, that is, with four or more brushes in multiple, and great improvements have been made in regard to the drum armature winding of this type.

Of great importance in selecting a motor is the question, What kind of iron, wrought-iron, cast-steel or cast-iron, is used for the magnet system? The kind of iron used affects not only the weight, but, what is more important, changes greatly the efficiency of a machine. The best way of forming a fair idea of this question is to compare two motors, one being made of cast-steel or wrought-iron, which are about the same, and the other of cast-iron. Supposing a 10 horse power motor of the horseshoe type, running at 800 revolutions per minute, is made of cast-steel. The efficiency curve must be of the form given in *B* in the cut; in other words, the machine should be able to work under a considerable overload for some time. If the motor is supplied from a 110 volt circuit, the current for a supposed commercial efficiency of about 90 per cent.=75.4 amperes. Of this current 2.7 per cent., or about two amperes, must be used to excite the (shunt) field, while the rest is going through the armature windings. The size of the




SELECTING AN ELECTRIC MOTOR.—CURVES OF EFFICIENCY.

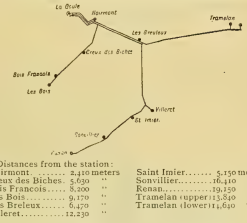
smooth-cored drum armature will be, in diameter and length, nine inches. The number of conductors around the armature core will be 174, wound in one layer; volts lost in the armature, 3. Hence the number of lines of force is $4.6 \times 10^6$. The number of lines of force being 10,000 per cm.$^2$ of the steel magnets and 13,000 per cm.$^2$ of the armature core, the cross-section of the magnets is 460 cm.$^2$ or about 72 square inches, and of the armature core (radial) 190 cm.$^2$ or about 30 square inches.

The length of ways for the magnetic lines are 110 cm. (44.5 inches) in the field, 25 cm. (10 inches) in the armature core, and 1.6 cm. (0.63 inch) for the (diametrical) air gap. The number of lines of force per cm.$^2$ of the air space will be 5,500.

If the leakage factor be 1.25 for the magnets and 1.1 for the armature, and the factor of the useful cross-section of the air space 0.9, the number of ampere-turns on the magnets is found to be 8,000 (about).[1] There being two magnet spools, the number of ampere turns for each spool is about 4,000. The mean length of one turn is 90 cm., or 35.4 inches. The cross-section of the wire, then, is 1.1 mm.$^2$, corresponding to a wire of about from No. 17 to No. 16 B. & S. Two amperes will be the exciting current, and hence the number of turns on each spool is 2,000. If the magnets are wound with No. 16 wire, the length of the wire will be 12,000 feet and its weight 95 pounds. The larger size of this wire will allow 10 per cent. for regulating purposes, so that the exciting current can be increased from two to 2.2 amperes.

Now, a motor of the same type, output and speed may be built with a magnet system of cast-iron. All dimensions given for the armature before hold good in this case. The only change is in the magnets.

The number of lines of force per square centimeter of




Distances from the station:

| | | | |
|---|---|---|---|
| Noirmont | 2,410 meters | Saint Imier | 5,150 meters |
| Creux des Biches | 5,630 " | Sonvillier | 16,410 " |
| Bois Francois | 8,200 " | Renan | 19,150 " |
| Les Bois | 9,170 " | Tramelan (upper) | 13,840 " |
| Les Breleux | 11,470 " | Tramelan (lower) | 11,640 " |
| Villeret | 12,230 " | | |

FIG. 1. TRANSMISSION OF ENERGY AT LA GOULE. RELATIVE POSITION OF ELEVEN VILLAGES TAKING CURRENT FOR POWER AND LIGHT FROM THIS PLANT.

the magnets will be 6,000; the cross-section of the magnet, then, is 120 square inches. The length of way for the magnetic lines is about 140 cm., or 57 inches. All other data being the same as before, the number of ampere-turns on the cast-iron magnets is 12,200 (about).

The magnets may be wound with the same weight of wire as in the steel motor. The mean length of one turn is 120 cm., or 47 inches. The proper size of wire then would be of 2.2 mm. cross-section; the number of turns on each spool 920; the weight (about the same as in the steel dynamo) as supposed, 97 pounds, and the current required to excite the field will be 6.6 amperes, against two amperes in the steel machine, or, for the same amount of wire wound on the magnets of both machines, the efficiency is about six per cent. less in the cast-iron motor than in the machine made of cast-steel. Practically the cast-iron motor will hardly be wound the way mentioned, for the current would be too heavy for the size of wire chosen. The proper way would be to wind the cast-iron magnets with a wire carrying per unit of area the same amount of current as in the steel machine (or in this case 1.8 amperes per mm.)[2] Then the magnets have to be wound with 1,530 turns of a 2.2 mm.$^2$ wire on each spool. The weight of the wire will be 160 pounds and the exciting current four amperes. In this case the result is that the cast-iron machine requires about 80 per cent. more copper wire on the magnets and its efficiency is still 2.7 per cent. lower than that of the steel machine.

It is practically out of the question to arrange the magnet windings of the cast-iron motor so that the exciting current is two amperes, just as in the cast-steel dynamo; if there were room enough for the field spools, nothing would prevent it. The same efficiency could be obtained by winding 320 pounds of a 2.2 mm.$^2$ wire on both spools, an amount of wire 240 per cent larger than that of the steel machine.

1. The values for the magnetic properties of cast steel are taken from the table published by the American Steel Casting Company

## Transmission of Energy at La Goule.

This installation, says *L'Eclairage Electrique*, is one of the most important in Switzerland. Eleven villages in the canton of Berne, situated at varying distances up

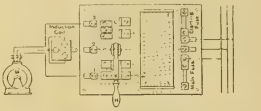



FIG. 2. TRANSMISSION OF ENERGY AT LA GOULE.—DIAGRAM OF THE CONNECTIONS FOR STARTING THE MOTOR BY USING THE NECTRAL WIRE OF A THREE-WIRE SYTEM.

to 24 kilometers from the generating station, are supplied with light and power from la Goule.

The Doube (which rises in the Jura, joins the Saone at Verdun-sur-Saone, and is navigable from Dole to its mouth) furnishes the power to actuate the machinery of the plant. The Doube furnishes a discharge of 15 cubic meters per second, with a fall of 26 meters, which gives an available energy of over 5,000 horse power. A race of 640 meters brings the water to the power house, which is arranged for the utilization of 2,000 horse power. Here are installed three horizontal Girard turbines of 500 horse power each, making 200 revolutions per minute, directly connected to three Oerlikon alternators. A special valve placed between the second and third turbines permits of the establishment of an artificial circulation in the water of the raceway when there is danger of freezing.

The alternate current is furnished at a pressure of 5,500 volts. The watch industry, which is the principal industry of the country, opens a valuable field for power application in addition to the demand for lighting the many workshops of the locality. The alternate system has been preferably accepted for lighting because of the uniformity it presents, and has also been given preference for power purposes. The wiring, however, is distinct for the two applications, but all the conductors are brought to the same switchboard.

The alternators, of the horizontal Oerlikon type, with removable fields, are mounted directly over the turbines. At 200 revolutions per minute, each, absorbing 500 horse power, furnishes 63 amperes at 5,500 volts, or an efficiency of 94 per cent. The frequency of the periods is 50 per second. The excitation of each alternator requires but 2,400 watts, or about 0.75 per cent. of the total power of the machine. The annular field is 2.5 meters in diameter, and weighs about 10 tons. The armature, with its two supports, weighs 12.5 tons. The exciters are of the ordinary bipolar form, furnish 30 amperes at 80 volts, with an angular velocity of 700 revolutions per minute, and are run by belts. The high-tension conductors have an extent of 36 kilometers, the wire measuring 300 kilometers, and weighing nearly 77 tons. There are three complete circuits of these for lighting and for power.

Fig. 1 shows the relative positions of the 11 villages supplied. The conductors vary from two to 7.5 mm. in diameter, and are supported on porcelain insulators fixed to wooden poles. Eighteen feeders leave the station and continue to Noirmont; this wiring represents about 250 kilogrammes of copper between each two posts. The fall of potential in the principal conductors attains a maximum of 10 per cent., and in the power mains as high as 20 per cent.

In each village a sub-station contains a transformer from which are fed the two systems for illumination and power for that locality. This wiring is on the three-conductor system, and is nearly all overhead. All the sub-stations are telephonically connected to the principal power station, and also to the headquarters of the company at Saint-Imier.

The motors, like the transformers, are of the Oerlikon type, of simple alternate current, with special arrangement for setting the apparatus in motion, in which the third wire is used.

It is generally understood that the starting up of this form of motor is somewhat difficult, but the Oerlikon company has overcome this objection by furnishing a sup-

plementary idle pulley, which permits the starting of the motor without any charge. The belt lies on the idle pulley; the motor moves, and when it has attained its normal speed the idle pulley is pressed up against the driver pulley, where it is held by friction. As soon as this is under full headway, the belt is changed over, and the idle pulley is disengaged from the belt.

In Fig. 2 is shown the motor connections. The switch *H* is double-throw. For putting the motor in motion, this switch, standing in an intermediate between *L* and *K*, has stopped the machine by opening the circuit. To start the motor the lever *H* is thrown up to the jaws *L*, where two plates on the lever make three contacts on the left with the two on the right. The starting current will then flow through the middle wire and one of the outer wires, the principal coil of the motor being connected to the terminals *1* and *2* and starting coil to terminals *2* and *3*. When the armature is under full motion—in about 30 seconds—the handle *H* is thrown down to its position at *K*, and left during the run of the motor—the current now flowing through the two outer conductors.

If an induction coil is placed in wire No. 2 of the motor its core should be pushed in before *H* is closed on *L*, and gradually withdrawn after the starting of the motor.

The installation is continuously operated thoughout the year, except for half an hour each day at noon.

Patrons pay 1.35 francs per light per year, and 325 francs per horse power per year for motors of two to 12 horse power. Above this last special contracts are made.

## Study of the Torpedo Ray.

M. A. d'Arsonval, member of the Institute, at the meeting of the International Society of Electricians, December 4th, communicated the results of investigations which he had conducted with electrical torpedoes.

The Raia torpedo (Lin.) shown in the cut is a fish with a large body, flat horizontally and nearly oval. It is very voracious, has sharp teeth, but is devoid of stings, like some others of the family. It is capable of giving severe shocks, of which M. d'Arsonval has undertaken to measure the power. By means of especial apparatus a curve of this discharge has been quite correctly registered. When the fish is freshly caught and not fatigued, the registering curve shows a discharge of 11 amperes, with a mean potential of 25 volts.

The fish which M. d'Arsonval had was white underneath, its back a dark reddish cinder color, with large round black blotches. The eyes and air-holes are visible in the illustration. The former are capable of rotary motion, describing a half circle, so as to cover a large field of vision without moving the body. The electric organs are made up of two lobes on either side of the fish. Removing the skin discovers a series of hexagonal prisms like honey-comb. M. Ranvier has carefully studied the anatomy of the torpedo, and, without entering into details, it may be stated that this is a veritable voltaic battery, with 2,000 couples in series, 500 of these cells being located in each of the four lobes mentioned.

The upper surface of the fish is the positive and the under side of it the negative pole of this animal battery. M. d'Arsonval drew from its tank the fish which had been caught the previous day at Concarneau and placed it upon a sheet of tin, which thus became the negative contact. He then placed on the back of the fish a second connection of large capacity attached to a six-volt lamp, and on making the final close of the circuit the fish three times lighted the little lamp, to the great delight of the audience.

## Proposed Technical Club in Chicago.

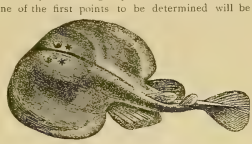
A movement is on foot among engineers, architects, railway men and representatives of allied interests in Chicago to organize a social technical club somewhat on the lines of the Engineers' Club of New York. It is proposed to provide, at the usual accommodations of a club including a restaurant and a rather large number of sleeping rooms, and to maintain them in a thoroughly comfortable and desirable manner on a low basis of dues. It is anticipated that the non-resident membership will be large and a special feature of the club, and a number of out-of-town professional men have already signified their intention to join in the movement. About one hundred have been secured in addition to the active membership. Electrical engineers are of course included, and the call is signed, among others, by A. W. Wright, E. J. Arnold and John C. McMaster.

## Calcic Carbide Plant at Niagara Falls.

By Orrin E. Dunlap.

It is expected that before this month ends calcic carbide will be made in the new plant at Niagara Falls. This plant is the first one of its kind in America. Considering the great interest now manifested in acetylene gas, which is made from calcic carbide, there is little wonder that close watch is being kept on the Niagara plant in anxious waiting for results to indicate the probable success of this new industry. The product of this initial plant will be sent to Philadelphia in barrels and there manufactured into acetylene gas to supply southern Pennsylvania.

As this plant is the first of its kind it is but natural that many interesting experiments will be made in it. One of the first points to be determined will be the



STUDY OF THE TORPEDO RAY.

amount of electric current which will prove the most economical, for so far the experiments have been made with current varying from 25 horse power to 235 horse power. The contract of the company with the Niagara Falls Power company calls for 1,000 or more horse power, a force much larger than before used. One important feature of this plant is that an alternating current furnace is to be used, whereas all the other electric manufacturing plants at Niagara Falls use direct current. The current is received all on one phase and used at a voltage of about 100. At the commencement it is likely that the furnaces will be operated with a current ranging from 100 to 1,000 horse power, and it is possible from the dimensions of the furnaces that a current of 500 horse power will be found the most economical.

The present size of the Niagara carbide plant, an exterior view of which is shown, is 50 by 100 feet at the foundation. The structure is of brick, the front portion being two stories high or 41 feet to the eaves. It contains a furnace room, a crushing and grinding room, a laboratory, a switchboard room, a transformer room and a room for the help employed. The crushing and grinding portion of the outfit is to be of sufficient capacity to supply a plant of 50 tons capacity, whereas the capacity of the plant at the start will be at least five tons per day. Two three-phase 75 horse-power motors will operate the crushing plant. In the furnace room four furnaces have been built, each containing cast iron cubicles three feet six inches long, two feet eight inches deep, and two feet two inches wide. The current will be kept on each furnace for about three hours, one furnace being operated at a time. Each horse power used is supposed to give 20 pounds of calcic carbide each 24 hours, and each pound of the product is supposed to produce a little over five cubic feet of gas. This is a busy month at the plant. The General Electric company's force came on from Schenectady to install the electrical equipment, while the force from the parent plant in North Carolina, and J. M. Morehead of New York, the engineer in charge of the erection, are devoting their united efforts to hurrying the plant to completion, so that by February 1st, at the latest, the factory may be in operation.

From the fact that calcic carbide is made from such low-priced materials as coal dust, lime dust and water, and that it can be made almost anywhere, there is no telling the revolution it may create, especially as it is recognized as the highest illuminant hydrocarbon known in chemistry. The company that owns the plant at the Falls makes the claim that acetylene "gives more light, throws out less heat, consumes less oxygen and can be produced at much less cost than any other illuminating gas. It is capable of being stored as a solid in the shape of calcic carbide, as a liquid or as a gas. It may be shipped long distances as carbide or as a compressed liquid gas manufactured from it, and in the latter state may be applied to all purposes of isolated lighting, especially for railroad trains, street cars, carriages, bicycles, steamships or sailing vessels, street lighting, and it may be used in stores, dwellings or manufactories, its application for the latter purpose permitting the manufacture of a gas sufficiently low priced to be used for fuel or heating purposes." It was formerly believed that some day great trains of storage batteries would be sent to all parts of the country from Niagara, but it may be that acetylene gas cylinders will take the place of storage batteries in this respect.

It is altogether likely that calcium carbide will be manufactured in the plant here at a cost not to exceed $5 per ton. In this connection the promoters of the plant give some interesting figures. Assuming that 20 pounds of carbide are produced each 24 hours by each horse power used, the amount made during 300 working

CALCIC CARBIDE PLANT AT NIAGARA FALLS.

days would be three tons per horse power per year, and applying the 100,000 horse power available from the present tunnel it would mean the production of 300,000 tons per year. This, they say, should produce at least 6,000,000,000 feet of acetylene gas, which as its illuminating abilities as compared with coal gas are as 10 to one, would represent all of 45,000,000,000 cubic feet of this gas, an amount that equals if not exceeds the annual output of coal gas throughout the whole United States. An important feature of acetylene is that the heating effect of its flame is but little more than that of an electric incandescent lamp. As the supply of the Niagara factory is to be shipped in barrels to Philadel

phia in the form of calcic carbide, it is natural they should compare the illuminating qualities of their product with the gas now used in that city. In this connection it is said that when acetylene is burned at the rate of five cubic feet per hour it produces a light equal to 250 candles, while it is further pointed out that the best illuminating gas from coal or water is seldom over 22 candles for each five cubic feet consumed per hour. The Philadelphia gas, it is pointed out, is equal to 19 or 20 candles. Thus it will be seen that acetylene will produce at least 12½ times more light for the same quantity consumed, or, in other words, 1,000 cubic feet of acetylene gas will furnish the equivalent in lighting power of 12,500 cubic feet of Philadelphia coal gas, and furthermore a three months' supply of acetylene for a good sized house can be stored in a cylinder six inches in diameter and 4½ feet long. But these figures have mainly to do with the value of acetylene as an illuminant, in addition to which its commercial value for power and heating purposes is to be taken into consideration and studied. There is no doubt that other factories for the manufacture of calcic carbide to supply New York, Massachusetts, Ohio, Northern Pennsylvania, Indiana, Illinois, Rhode Island, Connecticut, Missouri, Michigan, Minnesota and other states are likely to be erected at the Falls, because of its proximity to the fields from which the materials used in its manufacture are obtained, and also because of the great supply of cheap electrical power obtainable there.

## Pollak's Current Rectifier.

Among the recent consular reports issued by the state department at Washington is one prepared by Frank H. Mason, United States consul-general at Frankfort, in which the gleichrichter invented by C. Pollak and described in the WESTERN ELECTRICIAN of November 16, 1895, is given considerable prominence. Mr. Mason explains that electricity is supplied at Frankfort from the municipal central station at 7¼ pfennigs (a little more than 1¾ cents) per unit, in the form of single-phase alternating currents of 3,000 volts. At the accumulator works, where the Pollak system has now been in successful operation for more than a year, this current is reduced by transformers to 65 volts and then rectified—that is, converted into a direct current by the new device, which is illustrated in Fig. 1. For this purpose, the invention employs two collector rings and two rows of commutator bars, the latter insulated from each other and the shaft and alternately connected with the rings. The alternating currents, having been received from the central station and reduced to 65 volts, enter the machine through brushes resting on the rings. The direct current is taken off by four more rows of brushes arranged adjustably, the first and third and the second and fourth rows being connected with each other. The rectifier is turned by a synchronous motor of small dimensions, which receives its alternating currents, likewise reduced to 65 volts, from a small special transformer provided for that purpose. The outer circuit of the continuous current which passes from the rectifier includes an automatic disconnector, fluid resistance amperemeter, and, in various parallel shunts, electric motors and cells and other apparatus. The converted current produced by the rectifier is not entirely continuous, but pulsating, the length of the pulsations being governed by the width of the commutator bars and the speed of the central generator. The duration of contact can be regulated by adjustment of the brushes, and this adjustment should be so made that the electro motive force of the current will not fall below that of the battery, which would otherwise charge back into the circuit.

According to the same authority, four of these rectifiers, as shown in Fig. 2, each for 350 amperes, have been in continuous service day and night at the works of the company in Frankfort for more than a year, with such complete success that the system may be fairly claimed to have passed the experimental stage. Their efficiency is stated to be 96 per cent.

# COMMUNICATION.

## Joint Meeting of Committees on Rules Postponed.

*To the Editor of the* WESTERN ELECTRICIAN:

The committee on standard rules for electrical construction and operation of the National Electric Light association issued a call several months ago inviting the American Institute of Electrical Engineers, the American Street Railway association, the National Board of Fire Underwriters, the International Fire Chiefs' association, the American Institute of Architects, the American Bell Telephone company, the Western Union Telegraph company, the Postal Telegraph company, the General Electric company and the Westinghouse Electric & Manufacturing company to co-operate with it in the formation of a joint committee to consider generally the subject of electrical rules, with a view of securing the promulgation and enforcement of one standard set of rules for electrical construction and operation a set of rules which would meet the hearty approval of the various allied interests above referred to as well as the world at large.

A call for this joint meeting was issued for January 18, 1896. It was subsequently deemed desirable, in view of the short amount of time in which to secure the co-operation of the various interests invited, as well as to do certain preliminary work prior to the meeting, that the date of the meeting be postponed until March 18, 1896, and notice of this change in the date was sent to each of the parties.

In view of the fact that this proposed meeting has

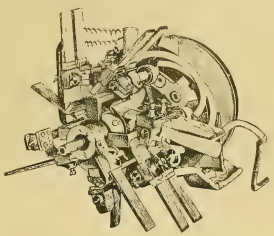


FIG. 1. POLLAK'S CURRENT RECTIFIER

been commented upon quite extensively through the electrical press, will you kindly call attention to the postponement?

It also affords me pleasure to state that nearly all the parties who have been invited to send a delegate to this joint meeting have already accepted and have sent me notification of their acceptance and the appointment of their representative. This is most encouraging. I have no doubt that the others will also act in accord in this most important matter.

WILLIAM J. HAMMER,
Chairman Committee, National Electric Light association, 1305 Havemeyer building, New York.
*Columbus, O., January 7, 1896.*

## Long-distance Telephone Company Objects to Chicago Tax Assessment.

In a bill filed in the Superior Court at Chicago last week the American Telephone & Telegraph company

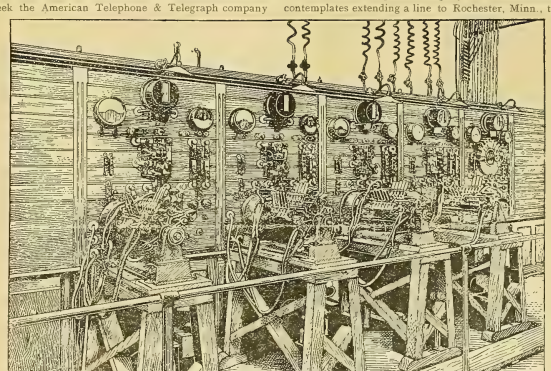


FIG. 2. POLLAK'S CURRENT RECTIFIER.

seeks to enjoin Collector James A. Hogan from enforcing the collection of taxes on the company's property for the year 1895.

The bill alleges that in June last the company received a notice from A. L. Thomas, the assessor, that the personal property of the company in its office at 167 Plymouth place, Chicago, had been assessed at $2,000, and the property in the other office of the company at 105–107 Quincy street had been valued at $800. This made a total assessment of $2,800, and the notice from the assessor said that if this assessment was not satisfactory the company had the privilege of filing a schedule showing the exact amount of property it possessed. The bill alleges that the company was satisfied with the $2,800 assessment and filed no schedule, but last month it received another notice, this time from Collector Hogan, to pay $2,142.72 personal property tax on an assessment of $20,000, which had been increased by the state board of equalization to $23,800.

The company declares that it was taken by surprise when this notice from the collector that the assessment was $20,000 instead of $2,800 reached it. The court is told that a mistake must have been made when the original assessment was copied from the assessor's books into those of the collector, although Assessor Thomas has refused to permit the company to examine his books. The court is asked to restrain the collector from collecting more than $299.98, the amount due on the original assessment of $2,800. The bill says that the property of the company consists of instruments, wires and connections used in the company's long-distance telephone system to the eastern cities, and if the collector is permitted to interfere with its property great damage to the company will result.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Northwestern Telephone Exchange company is rebuilding its exchange at Mankato, Minn.

L. G. Vogel and August Warner are soliciting contracts at New Ulm, Minn., and if they secure contracts for 75 instruments will put in a telephone exchange.

The Northwestern Telephone Exchange company is considering the extension of its line from Fargo, N. D., to Lisbon, N. D., and it will probably be built in the spring.

The Ripon Telephone company, a branch of the Standard Telephone & Electric company of Madison, Wis., has been incorporated at Ripon, Wis. The company expects to make connections with the Ripon, Spring Grove and Tuleta Hills company.

A reduction in price has been granted the city of St. Paul for telephone rent, by having the police telephones disconnected from the central office, and placing 13 instruments used by the fire department on private wires and disconnecting them from the central office. This will result in an annual saving of $456.

The Winona Telephone company of Winona, Minn., contemplates extending a line to Rochester, Minn., the Rochester company to pay half the expense. The estimated cost of the extension is $4,000.

The Home Telephone company of Sioux City, Ia., has a franchise for an exchange in South Sioux City Neb., which expires January 30th. It is understood the company will begin work before that time on the extension.

A new switchboard has been put in at Menominee, Mich.

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**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome, and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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A word of congratulation and encouragement is due the Northwestern Electrical association at this time. It is the earnest wish of friends of that organization that it will continue to adhere to the policy which it has thus far followed with so much credit to itself and benefit to the community. The Milwaukee convention this week should be another successful meeting and we have no doubt that it will be.

It was all wind that blows nobody good. The recent fire in our printing office was indeed annoying, but it has proved the occasion of many kind words from friend and contemporaries, for which we return our best thanks. Our readers too will have the advantage of reading a journal printed entirely from new type of the most modern and desirable face. The type destroyed in the fire had only been in use a few months, and is now again succeeded by a brand-new dress.

Franklin memory is honored in Chicago and in many other large cities of the country each year by public meetings at which addresses are delivered recalling the eminent character and the great achievements of this illustrious American. It would be very appropriate for the electrical fraternity to take a prominent part in these memorial meetings and recall to the minds of the present generation the fact that Dr. Franklin's contributions to electrical science entitle him to a place among the leading scientists of the world. In these days of hurry and bustle so much attention is given the commercial features that we are liable to pass over the work of such men as Franklin if we are not frequently reminded of the important bearing it had upon electrical science.

In these days it is difficult to start any topic of national or international discussion that does not touch upon some point of electrical interest. The present disturbed state of feeling in England and Germany over affairs in the Transvaal illustrates this. The Associated Press correspondent in Berlin telegraphs that several of the newspapers in that capital point out that Germany has big commercial interests in the Transvaal. It is said that "many important factories have been built in the Transvaal by Germans, and the Siemens company has erected there the most important electric power transmission plant in the world, producing 4,000 horse power." Aside from the intrinsic interest of this statement, it is curious that the German press should overlook the 15,000 horse power Niagara plant, which has attracted attention the world over, in claiming the "most important electric power transmission plant in the world" for a German enterprise in South Africa.

For an exhibition of ground and lofty tumbling we commend the performance of Mayor Pingree of Detroit and Tom Johnson, who has been trying to engage in business in Pingree's bailiwick. It should be borne in mind that Johnson's performance at Detroit was given in his capacity as a street railway magnate, which is, of course, a very different role from that of general reformer in which he delights to pose before his Ohio constituency. Pingree, it must be admitted, is far more effective than Johnson, if not so versatile. The latter has been successful, though, and his policy may serve as an example to others desiring fame as reformers without interfering with their pursuit of fortune to enjoy in private. He has never permitted his reform ideas to interfere with his business; he is a money maker first, a reformer after business hours only. On the other hand, the picturesque Pingree is a reformer at all times, and he is never so happy as when he is meddling with somebody else's business.

The "professor" is at it again—begging for money to extend his electro-political system upon which the city of Chicago has the misfortune to depend, in a measure, for the lighting of its streets. He has now reached the point of admitting that "Chicago's electric light plant is operated, for various reasons, just beyond the line of economy." That is certainly quite a concession—coming from John P. Barrett, heretofore the greatest braggart in the electrical business. However, he does not mention the chief reasons for the marked lack of economy in his plants—his own incompetence and the political operation of the municipal lighting system. Detroit, which he cites approvingly, has wisely placed its electric lighting interests in charge of an electrical engineer—a man who knows what he is about. Fortunately, in the present state of the city treasury, it is unlikely that the clamor for more money will be heeded. Barrett and his ill-managed, unsatisfactory lighting service already cover too much ground. Let them at least be confined within their present limits.

Change in conditions is frequently followed by change of opinion. This is shown by the manner in which the promoters of the "Brandenburg under-car system" have modified their policy during the last two months. It will be remembered that these worthy gentlemen, who ever they may be, offered to equip and operate the Indiana avenue line of the Chicago City Railway company under the Brandenburg patents, in order to demonstrate the practicability of the scheme. They were positive in their statements they had faith in their project, and they agreed to put up a bond of $100,000 for the performance of their contract. The offer was not accepted, but a company was formed by these promoters for the purpose of establishing independent street railway lines to be equipped with the Brandenburg system and operated in competition with the trolley and cable lines. This company last week secured the passage of an ordinance by the Chicago City Council granting it valuable franchises in South Side streets, but the ordinance does not restrict the company to the use of an underground electric conduit system. The storage battery and overhead trolley may also be used under the terms of this grant. In explanation of this elastic provision in the ordinance, the promoters say that the insertion of the clause making overhead or underground systems optional was insisted upon by the underwriters of their bonds. They claim that the financial backing of their company could not be secured beyond question in any other way. So this company, with its boasted "unlimited backing," was obliged to depend upon the much-abused overhead trolley for standing in the financial world.

Opposition to this grant has been very bitter, and the president of the City Railway company, over his own signature, pronounces the enterprise an attempt to blackmail his corporation; he also charges that illegal measures have been resorted to in securing signatures, and that many forgeries have been committed by the new company's agents. For an enterprise presumably in the interest of the public the project is certainly encountering great opposition from those whom it is supposed to benefit.

In Governor Morton's annual message to the Legislature of New York he called attention to the law passed by that body in 1895, providing for submitting to the people, at the general election in that year, the proposition to issue bonds of the state, not to exceed $9,000,000, for the improvement of the Erie, Champlain and Oswego canals by deepening the Erie and Oswego canals to a depth of not less than nine feet, and the Champlain canal to seven feet of water, and also lengthening and improving the locks and strengthening the walls of the canals. The act was approved by the people by a very decisive vote, and the state is thus committed to the improvement contemplated by the law. The deepening and enlargement contemplated will doubtless greatly increase the carrying capacity of the canals, and when the improvements are completed it will be possible to change the method of propulsion so as to permit the boats to be operated at considerably increased rates of speed. This will, of course, be the all-important consideration, provided an economical system of propulsion is adopted. It is evident that the governor looks with favor upon the plan to introduce electricity as the motive power, and it is believed that in this he reflects the opinion of the superintendent of public works and other state officials who give especial attention to canal management. On this point the governor says:

> The recent experiments with electric motors for canal boats propulsion made at the western end of the Erie canal were so successful in character and results as to lead to the belief that when the system is applied to the entire canal it will increase its traffic capacity by at least 35 per cent. Viewing as a whole the many considerations embraced in this subject, it may safely be suggested that it is one of great importance, and not only merits but will doubtless receive your most earnest attention.

The official report of these experiments, together with the result of the tests, is presented on another page of this issue. City Electrician Barnes of Rochester, who had charge of the tests, seems to be convinced of the practicability of the plan tried at Tonawanda last October. The public exhibition of the working of the system was fully illustrated and described at the time in the WESTERN ELECTRICIAN. The subsequent tests were made under unusually trying conditions, the report says, and the good showing which the system is credited with having made has strengthened the belief of the projectors of the enterprise in the superiority of this plan. Mr Barnes says: "Taking the actual results, as they are, they go a long way toward demonstrating the fact that electric towage is feasible, practicable and full of promise in point of economy." And in another part of his report he says that the present plan has many advantages over the trolley system tried near Rochester when the proposition to introduce electricity in canal propulsion was first made. This report is the first official statement of the workings of the new system, and it should be carefully examined by all who are interested in the proposed innovation.

Superintendent Aldridge will advocate the adoption of electricity as a motive power upon the Erie canal, and an effort will be made to secure immediate action upon this subject. Considerable study and experimental work will be required to develop the plans under consideration, and it is to be hoped, as the governor suggests, that the matter will be given the attention which its importance deserves.

## Official Report of Experiments in Electric Propulsion on the Erie Canal.

Charles R. Barnes, city electrician of Rochester, N. Y., who was appointed by the state superintendent of public works, George W. Aldridge, to make an official examination of the system of electric propulsion which was publicly exhibited at Tonawanda on October 26th, has finished his tests and filed his report at Albany. Following is the full text of the report, from which it will be seen that the system is looked upon with much favor:

In accordance with your instructions, I have carefully investigated and tested the electric towing system constructed and operated by the Erie Canal Traction company at Tonawanda. This system is known as the Lamb electric towing system, and consists essentially of a stationary cableway supported by a line of poles along the canal bank, and electric motor carriages traveling thereon with the towing boat attached thereto.

In the experimental plant and equipment examined the cableway comprised a line 1¼ miles in length of poles 16 feet high from ground to top and well braced to withstand lateral strain. These poles were placed 125 feet apart and each carried two iron brackets, one mounted on top and one three feet below, which were provided with suitable saddles for the cables to rest in, the upper line of saddles being electrically insulated from the brackets. The upper line of brackets carried a cable 1¼ inches in diameter, while a five-eighths inch cable was suspended upon the upper line of brackets. The tow-motor consisted of a 22 horse power electric motor of the Storey type attached to a little truck having two grooved wheels, placed in tandem, in such manner that it would hang and travel on the upper cable. The motor armature was geared to a grooved sheave 20 inches in diameter, around which the lower cable had been given three turns, and by this means the motor could be propelled along, the cable being wound up forward and at the same time paid out behind. The electric current necessary for the operation was conducted along the upper (insulated) cable to the motor truck, thence through the controlling switch and rheostat to the motor armature, after leaving which it passed on to the lower (traction) cable, returning to the source of electricity partly through this cable and partly through the ground, to which the latter was suitably connected. Thus the upper cable served both as an electric conductor and a support for the tow-motor, while the lower cable afforded the necessary tractive medium and return conductor. The motor truck was provided with a seat for the man operating the motor. A tow-line connected the motor with the boat. In reference to this last mentioned feature, it should be added that it is proposed in practice to place the controlling device upon the boat itself and to use a metallic towline to electrically connect the motor with the controlling device, in order that the steersman may operate the motor himself, thus doing away with the motorman.

A public exhibition of the system was given October 26, 1895. A canal boat loaded to full capacity was towed up against the stream, and a train of five ordinary canal boats loaded with people was towed on the return trip. This exhibition was witnessed by ex-Governor Flower, by officers of the canal department and a large number of interested boat owners, and all present appeared well pleased with the operation of the system. Following this public exhibition, I have, with the assistance of competent electrical engineers, made a series of careful tests, extending over a period of several weeks, the results of which in tabulated form are hereto attached. The tables show the readings of electrical measuring instruments, taken at intervals of 15 seconds, and the power and speed data computed therefrom. For the purpose of these tests the state scow Tonawanda was used, and was towed up and down the experimental section a number of times, under varying conditions of wind and current. The Tonawanda weighed 60 tons, carried a load of 157½ tons, making a total displacement of 217½ tons, and drew 5½ feet of water. Each run was made over a distance of 2,145 feet, or 0.4062 mile.

Referring to the electrical measurement data it will be observed that the electromotive force fluctuated to a large extent, this being due to the fact that the current was taken from a street railway circuit, where the load is constantly varying. Of course this fluctuation tended to reduce the efficiency of the apparatus used in the experiment. If the traction system of the canal were supplied from power stations of its own, the pressure on the line would, from the very fact that in canal navigation such rapid changes of load would not occur as on an electric street railway, remain comparatively steady and the pull exerted by the motors on the tow lines would be correspondingly even. The motor had been designed for a 500 volt current, while the voltage actually available nearly always varied much below this value; this drawback was somewhat augmented by the fact that the reducing gear of the motor had been designed for conditions somewhat different from the actual conditions under which the experiment was made and which could not readily have been predetermined. As a result, the current consumed and the power developed by the motor averaged only about one-third of its rated capacity.

Electric towage being a new field for the application of electricity, experience is necessarily to be first secured by experiments such as the one under consideration. Taking the actual results, however, as they are, they go a long way toward demonstrating the fact that electric towage is feasible, practicable and full of promise in point of economy.

The vesel used in the experiment was a scow, which, for a given displacement, offers more resistance than an ordinary canal boat. Yet an average speed of about 2½ miles per hour was attained at the expenditure of only about 8½ electrical horse power for the 217½ tons towed. Taking these figures as a basis, together with the price at which the Erie Canal Traction company is bound by virtue of its franchise to furnish electric power to boatmen, namely, not to exceed $20 per horse power per season of navigation, which ordinarily covers 210 days, and assuming that the tow-motor worked constantly during the whole season, thus making 35 single trips between Buffalo and Troy with such vessels and at such speed as referred to, the cost per trip would be $\left(\frac{8.6\times\$20}{35}\right)$ less than $5. This, of course, does not allow for the delays in locks and elsewhere, during which the motor could not be turned to effect. But allowing for such delays, on the assumption that the Traction company is not to make any rebate for time during which power is not consumed, and further, taking into consideration that, if the boatman had his own tow-motor, a fair interest on the investment and an allowance for wear and tear thereon would have to be made; or, if the traction company rented out motors to the boatmen, that such rental would be added to the cost of power, the combined cost would certainly fall far short of the present cost of towage or propulsion. To further elucidate this point, the cost under the above assumed condition of continuous work would be, at $5 per trip, less than 1.4 cents per boat-mile. Now, assuming that during one-third of the entire time the motor remained idle at locks and elsewhere, although power was charged for just the same, then the cost per boat-mile covered would average 2.1 cents, or $7.66 per trip. If in addition to this a rental were charged for the motor, at the same rate per horse power and season as for the electric power itself, for the entire time, including the periods of idleness, the total cost per boat-mile run would amount to 4.2 cents, or $15.32 per trip. At this rate not only would power be cheap to the consumer, but the renting out of motors, I think, would prove a profitable enterprise.

The foregoing estimate, it is to be remembered, is based upon experimental results which, as pointed out, can be improved upon and a higher degree of efficiency attained; and as the tests were made with a single scow, it is obvious that with a train of canal boats the power consumed per ton-mile would be less, so that the estimate may be considered a conservative one. On the other hand, the speed factor, of course, is an important one in the calculation of the power. The energy consumed would vary, approximately, as the cube of the speed divided by the ratio of speed, whereas the item for motor depreciation or rental would vary as the power divided by that ratio. Thus, basing the calculation upon the data given, if the boat speed were to be, say, 3½ instead of 2½ miles per hour, the power would be increased from 8½ to about 23$\frac{1}{10}$ electrical horse power, the cost of the electric current from 2.1 cents to 4.1 cents per mile, and the item of motor depreciation or rental, also from 2.1 to 4.1 cents; this would make, together, 8.2 cents per mile, or $29.93 per trip, for the higher speed. A tow-motor running continuously would make 48 trips at the higher speed, against 35 trips at the lower speed per season; but if one-third the entire time were lost by delays, in either case there would be still be made 32 trips at the higher, or 23 trips at the lower speed, per season. Of course, the time allowance for delays, which is here assumed at one-third of the entire season, is an arbitrary one, and it seems rather unlikely that anywhere near as much time would necessarily be lost, especially not with the proposed improvements in the locks. There is no occasion for the tow-motors laying idle while the boats are loading or unloading, as is the case with horses or mules, for they may go on towing other boats after reaching destination and, therefore, the total idleness per season would not amount to as much with a tow-motor as with horses, mules or propellers. In view of this, the estimate given is believed to leave a good margin for still further economy. In fact, the results obtained from the experiment are so encouraging as to admit of a rather unusual liberality in making allowances and deducing estimates therefrom, without even taking into consideration any improvement in the efficiency of the system over that of the experimental equipment, and this fact has induced me to go beyond precedent in regard to estimates on canal traction, and include not only the cost of electrical energy, but also interest and depreciation on or rental for tow-motors, at what I deem an exceedingly liberal if not excessive figure.

Of the various systems that have been proposed or suggested for canal traction, the towage system seems to appeal most favorably to boatmen, as only the towing facilities require to be changed from the mule or horse to the tow-motor. The boatmen would be relieved not only of the uncertainty of the life and health of their animals, but the men necessary to attend the animals (usually one man per team) could be dispensed with entirely, while the space now reserved for the animals on board would be available for other purposes.

Having, in accordance with instructions of the superintendent of public works, made an investigation of and submitted a report on an electric trolley system, as applied to canal traction, toward the close of the year 1893, it seems proper here to draw a comparison between the general features of the electric trolley system of propulsion and the electric system of towage. The former includes a trolley line erected along or over the canal, supplying current to the motors. In this system either special propeller boats fitted with electrical machinery are to be built, or existing boats must be adapted to the purpose. The towing system, on the other hand, comprises a sort of cableway or railway erected along the canal bank, and tow-motors traveling thereon; this system eliminates the necessity of building propeller boats or of reconstructing old boats for the purpose, as no machinery would be required in the hold of the boat and no space therein be encroached upon. Another feature of some value is the absence of the wash unavoidable with propellers. The towage system, further, appears to afford greater flexibility of manipulation, as extra tow-motors could more readily and at less expense be kept in reserve at suitable points along the canal, to meet odd demands, than would be the case with propeller boats, and boats could be towed even singly or in couples with a fair degree of economy, not necessitating the making up of long trains as with propellers. In fact, as already pointed out, the estimates herein submitted are based upon the most uneconomical use of the power, namely, for single boats. For trains of boat, motors of suitable size and capacity could be built, or two or more motors coupled together to meet any demand.

Summing up, the electric towing system appears to present so many meritorious features that I have no hesitation in indorsing it as the system deserving preference over any other hitherto experimented upon or likely to be devised in the near future.

Following is a tabulated statement of the results of the experiments. In all tests observations were made at intervals of 15 seconds. Tests one to six inclusive were made against wind and current, the current velocity being about one mile per hour. Tests seven to 12 inclusive were made with wind and current:

TEST 1.

| Observation. | Amperes. | Volts. | E. H. P. | Observation. | Amperes. | Volts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | 23. | 350 | 10.79 | 25 | 23. | 500 | 15.41 |
| 2 | 17.5 | 420 | 9.85 | 26 | 22. | 400 | 11.79 |
| 3 | 20. | 400 | 10.72 | 27 | 20. | 450 | 12.00 |
| 4 | 25. | 351 | 11.76 | 28 | 10. | 450 | 6.03 |
| 5 | 13. | 425 | 7.40 | 29 | 20.05 | 390 | 10 71 |
| 6 | 21. | 410 | 11.54 | 30 | 26. | 350 | 12.20 |
| 7 | 10. | 500 | 6.70 | 31 | 20. | 375 | 10.05 |
| 8 | 25. | 350 | 11.72 | 32 | 20. | 380 | 10.18 |
| 9 | 7. | 410 | 3.84 | 33 | 20. | 400 | 10.72 |
| 10 | 12. | 420 | 6.75 | 34 | 21. | 390 | 10.71 |
| 11 | 22. | 330 | 9.73 | 35 | 19. | 410 | 10.44 |
| 12 | 8. | 450 | 4.82 | 36 | 22. | 400 | 11.79 |
| 13 | 23. | 300 | 9.24 | 37 | 18.5 | 410 | 10.16 |
| 14 | 11.5 | 300 | 4.46 | 38 | 20. | 405 | 10.85 |
| 15 | 19.5 | 400 | 9.67 | 39 | 18. | 355 | 8.56 |
| 16 | 29. | 370 | 14.38 | 40 | 17.5 | 375 | 8.80 |
| 17 | 19.5 | 375 | 9.80 | 41 | 17. | 420 | 9.57 |
| 18 | 19.5 | 375 | 9.80 | 42 | 18. | 410 | 9.89 |
| 19 | 13.5 | 410 | 7.40 | 43 | 19. | 415 | 10.56 |
| 20 | 15.5 | 355 | 7.37 | 44 | 14.5 | 385 | 7.48 |
| 21 | 17. | 335 | 7.36 | 45 | 19.5 | 395 | 10.32 |
| 22 | 16. | 395 | 8.47 | 46 | 18. | 400 | 9.65 |
| 23 | 11. | 325 | 4.79 | 47 | 19. | 425 | 10.82 |
| 24 | 15.5 | 375 | 7.64 | ........ | ....... | ....... | ........ |

Total number of observations, 47. Duration or run, 11¾ minutes. Average of observations, 18.2 amperes, 391.9 volts, 9.5 electric horse power. Average speed, 2.07 miles per hour.

TEST 2.

| Observation. | Amperes. | Volts. | E. H. P. | Observation. | Amperes. | Volts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | 30. | 425 | 17.09 | 24 | 20. | 400 | 10.72 |
| 2 | 20. | 400 | 10.72 | 25 | 21. | 375 | 10.58 |
| 3 | 25. | 355 | 10.55 | 26 | 20. | 395 | 10.58 |
| 4 | 28. | 350 | 13.13 | 27 | 21.5 | 400 | 11.52 |
| 5 | 22.5 | 420 | 12.66 | 28 | 20. | 390 | 10.45 |
| 6 | 21.5 | 360 | 10.37 | 29 | 21. | 380 | 10.69 |
| 7 | 19. | 405 | 10.18 | 30 | 21. | 395 | 11.1 |
| 8 | 20. | 395 | 10.58 | 31 | 20. | 380 | 10 18 |
| 9 | 18. | 420 | 10.13 | 32 | 21.5 | 380 | 10.95 |
| 10 | 18.5 | 415 | 10.29 | 33 | 19. | 420 | 10.67 |
| 11 | 16. | 480 | 10.22 | 34 | 21.5 | 405 | 11.67 |
| 12 | 17.5 | 420 | 9.85 | 35 | 20.5 | 375 | 10.3 |
| 13 | 18. | 415 | 10. | 36 | 21.5 | 415 | 11.96 |
| 14 | 17. | 415 | 9.45 | 37 | 22. | 385 | 11.35 |
| 15 | 17.5 | 415 | 9.73 | 38 | 23. | 420 | 12 94 |
| 16 | 16.5 | 405 | 8.93 | 39 | 23. | 395 | 12.24 |
| 17 | 19. | 410 | 10.44 | 40 | 23. | 385 | 11.87 |
| 18 | 18. | 415 | 10.01 | 41 | 21. | 400 | 11.26 |
| 19 | 19. | 415 | 10.56 | 42 | 20. | 375 | 10.18 |
| 20 | 19. | 410 | 10.44 | 43 | 18.5 | 405 | 10.04 |
| 21 | 19. | 395 | 10.06 | 44 | 17.5 | 385 | 9.03 |
| 22 | 20. | 405 | 10.85 | 45 | 19. | 420 | 10.67 |
| 23 | 21. | 400 | 11.26 | 46 | 20. | 425 | 11.39 |

Total number of observations, 46. Duration of run, 11½ minutes. Average of observations, 20.3 amperes, 400 volts, 10.8 electric horse power. Average speed, 2.12 miles per hour.

TEST 3.

| Observation. | Amperes. | Volts. | E. H. P. | Observation. | Amperes. | Volts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | 22.5 | 355 | 10.7 | 24 | 16.5 | 405 | 8.93 |
| 2 | 23. | 380 | 11.71 | 25 | 18. | 415 | 10. |
| 3 | 20. | 390 | 10.45 | 26 | 16. | 425 | 9.11 |
| 4 | 21. | 400 | 11.26 | 27 | 16.5 | 400 | 8.84 |
| 5 | 19. | 400 | 10.18 | 28 | 17. | 420 | 9.57 |
| 6 | 19. | 415 | 10.56 | 29 | 17.5 | 420 | 9.85 |
| 7 | 17.5 | 410 | 9.61 | 30 | 16.5 | 425 | 9.4 |
| 8 | 19. | 405 | 10.18 | 31 | 17.5 | 410 | 9.61 |
| 9 | 17. | 405 | 9.22 | 32 | 18. | 485 | 11.7 |
| 10 | 17. | 420 | 9.57 | 33 | 18. | 395 | 9.53 |
| 11 | 17. | 405 | 9.22 | 34 | 15. | 420 | 8.44 |
| 12 | 15. | 405 | 8.14 | 35 | 16. | ....... | ........ |
| 13 | 17. | 410 | 9.34 | 36 | 19. | 460 | 11.71 |
| 14 | 18. | 420 | 10.13 | 37 | 21. | 385 | 10.83 |
| 15 | 16.5 | 415 | 9.17 | 38 | 10. | 350 | 4.69 |
| 16 | 17.5 | 410 | 9.61 | 39 | 15.5 | 345 | 7.16 |
| 17 | 17.5 | 405 | 9.5 | 40 | 18. | 345 | 8.32 |
| 18 | 18. | 405 | 9.77 | 41 | 19. | 385 | 9.8 |
| 19 | 16. | 410 | 8.79 | 42 | 16.5 | 450 | 9.95 |
| 20 | 17. | 400 | 9.11 | ........ | ....... | ....... | ....... |
| 21 | 15. | 490 | 9.85 | ........ | ........ | ....... | ........ |
| 22 | 17. | 405 | 9.22 | ........ | ........ | ... .. | ........ |
| 23 | 17. | 395 | 7.66 | ........ | ........ | .. .... | .. .... |

Total number of observations, 42. Duration of run, 10½ minutes. Average of observations, 17.5 amperes, 397.5 volts, 9.3 electric horse power. Average speed, 2.32 miles per hour.

TEST 4.

| Observation. | Amperes. | Volts. | E. H. P. | Observation. | Amperes. | Volts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | 24. | 370 | 11.9 | 22 | 18. | 410 | 9.89 |
| 2 | 22. | 385 | 11.35 | 23 | 18.5 | 405 | 10.04 |
| 3 | 20.5 | 395 | 9.51 | 24 | 18. | 410 | 9.89 |
| 4 | 19.5 | 415 | 10.84 | 25 | 18. | 410 | 9.89 |
| 5 | 19.5 | 420 | 10.97 | 26 | 17. | 410 | 9.34 |
| 6 | ...... | ...... | ...... | 27 | 17. | 410 | 9.34 |
| 7 | 11. | 445 | 6.46 | 28 | 17. | 410 | 9.34 |
| 8 | 8. | 455 | 4.89 | 29 | 17.5 | 415 | 9.73 |
| 9 | 10. | 450 | 5.96 | 30 | 18. | 420 | 10.13 |
| 10 | 15. | 445 | 8.94 | 31 | 17. | 415 | 9.45 |
| 11 | 21. | 400 | 11.26 | 32 | 18. | 410 | 9.89 |
| 12 | 22 | 415 | 12.23 | 33 | 17.5 | 415 | 9.73 |
| 13 | 20. | 410 | 10.99 | 34 | 18. | 405 | 9.77 |
| 14 | 19. | 410 | 10.44 | 35 | 17.5 | 415 | 9.73 |
| 15 | 18. | 415 | 10. | 36 | 18. | 410 | 9.89 |
| 16 | 17.5 | 405 | 9.5 | 37 | 18.5 | 410 | 10.16 |
| 17 | 17.5 | 405 | 9.5 | 38 | 17. | 400 | 9.11 |
| 18 | 18. | 410 | 9.89 | 39 | 17.5 | 400 | 9.38 |
| 19 | 17.5 | 415 | 9.73 | 40 | 18. | 425 | 10.25 |
| 20 | 17.5 | 410 | 9.61 | 41 | 16. | 405 | 8.68 |
| 21 | 18. | 415 | 10. | 42 | 17.5 | 415 | 9.73 |

Total number of observations, 42. Duration of run, 10½ minutes. Average of observations, 17.2 amperes, 402.7 volts, 9.2 electric horse power. Average speed, 2.32 miles per hour.

TEST 5.

| Observation. | Amperes. | Volts. | E. H. P. | Observation. | Amperes. | Volts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | 26. | 315 | 10.98 | 23 | 17. | 340 | 7.74 |
| 2 | 20.5 | 345 | 9.48 | 24 | 20. | 400 | 10.72 |
| 3 | 20. | 325 | 8.71 | 25 | 19. | 400 | 10.19 |
| 4 | 21. | 375 | 10.55 | 26 | 18.5 | 410 | 10.17 |
| 5 | 21. | 410 | 11.54 | 27 | 18. | 420 | 10.18 |
| 6 | 15. | 355 | 7.13 | 28 | 16.5 | 415 | 9.18 |
| 7 | 13. | 325 | 5.66 | 29 | 17. | 415 | 9.46 |
| 8 | 13. | 350 | 6.10 | 30 | 15. | 385 | 7.74 |
| 9 | 14.5 | 345 | 6.60 | 31 | 11.5 | 310 | 4.78 |
| 10 | 17.5 | 375 | 8.79 | 32 | 13. | 350 | 6.10 |
| 11 | 19. | 400 | 10.19 | 33 | 17.5 | 385 | 8.90 |
| 12 | 18. | 405 | 9.77 | 34 | 20. | 410 | 10.99 |
| 13 | 12.5 | 380 | 6.37 | 35 | 19. | 410 | 10.44 |
| 14 | 13. | 335 | 5.84 | 36 | 18. | 410 | 9.89 |
| 15 | 13.5 | 325 | 5.88 | 37 | 19.5 | 410 | 10.71 |
| 16 | 15. | 340 | 6.83 | 38 | 18.5 | 420 | 10.41 |
| 17 | 15.5 | 330 | 6.86 | 39 | 17.5 | 405 | 9.50 |
| 18 | 18. | 380 | 9.17 | 40 | 17.5 | 405 | 9.50 |
| 19 | 18.5 | 385 | 9.54 | 41 | 17. | 410 | 9.34 |
| 20 | 16.5 | 350 | 7.74 | 42 | 15. | 410 | 8.24 |
| 21 | 13. | 310 | 5.40 | 43 | 17. | 415 | 9.45 |
| 22 | 15.5 | 330 | 6.86 | ...... | ...... | ...... | ...... |

Total number of observations, 43. Duration of run, 10¾ minutes. Average of observations, 17 amperes, 374.8 volts, 8.5 electric horse power. Average speed, 2.26 miles per hour.

TEST 6.

| Observation | Amperes. | Volts. | E. H. P. | Observation. | Amperes. | Volts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | 25. | 385 | 12.9 | 21 | 16. | 410 | 8.78 |
| 2 | 21.5 | 375 | 10.80 | 22 | 17.5 | 420 | 9.85 |
| 3 | 20. | 400 | 10.72 | 23 | 17. | 430 | 9.79 |
| 4 | 18. | 400 | 9.65 | 24 | 17. | 420 | 9.57 |
| 5 | 19. | 420 | 10.69 | 25 | 16. | 425 | 8.68 |
| 6 | 17.5 | 420 | 9.85 | 26 | 16. | 405 | 8.68 |
| 7 | 15 | 390 | 7.84 | 27 | 17. | 415 | 9.45 |
| 8 | 16.5 | 420 | 9.28 | 28 | 17.5 | 425 | 9.97 |
| 9 | 16.5 | 420 | 9.28 | 29 | 16.5 | 410 | 9.06 |
| 10 | 16.5 | 425 | 9.4 | 30 | 16.5 | 410 | 9.06 |
| 11 | 15.5 | 415 | 8.62 | 31 | 17. | 420 | 9.57 |
| 12 | 15 | 410 | 8.24 | 32 | 16.5 | 410 | 9.06 |
| 13 | 17. | 415 | 9.45 | 33 | 17.5 | 400 | 9.38 |
| 14 | 16. | 400 | 8.57 | 34 | 18. | 430 | 10.37 |
| 15 | 16 | 410 | 8.78 | 35 | 17. | 415 | 9.45 |
| 16 | 14. | 415 | 7.78 | 36 | 17. | 405 | 9.57 |
| 17 | 16. | 405 | 8.68 | 37 | 16. | 420 | 9. |
| 18 | 19. | 425 | 10.82 | 38 | 15. | 435 | 8.74 |
| 19 | 17. | 425 | 9.95 | 39 | 15. | 425 | 8.54 |
| 20 | 17.5 | 410 | 9.61 | .... | ...... | .... | .... |

Total number of observations, 39. Duration of run, 9¾ minutes. Average of observations, 17.05 amperes, 413.2 volts, 9.4 electric horse power. Average speed, 2.5 miles per hour.

TEST 7.

| Observation. | Amperes | Volts. | E. H. P. | Observation. | Amperes. | Volts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | 9 | 415 | 5. | 19 | 12.5 | 450 | 7.54 |
| 2 | 12 | 425 | 6.7 | 20 | 12. | 435 | 6.99 |
| 3 | 15 | 430 | 8.64 | 21 | 12 | 430 | 6.91 |
| 4 | 18 | 410 | 9.89 | 22 | 12. | 440 | 7.07 |
| 5 | 15.5 | 420 | 8.72 | 23 | 10 | 435 | 5.83 |
| 6 | 15 | 430 | 8.64 | 24 | 12 | 435 | 6.99 |
| 7 | 13 | 425 | 7.4 | 25 | 9. | 415 | 5 |
| 8 | 13.5 | 440 | 7.96 | 26 | 10. | 450 | 6.03 |
| 9 | 13 | 450 | 7.94 | 27 | 12 | 435 | 6.99 |
| 10 | 13 | 445 | 7.75 | 28 | 12 | 440 | 7.07 |
| 11 | 12.5 | 455 | 7.62 | 29 | 12.5 | 455 | 7.62 |
| 12 | 12.5 | 455 | 7.62 | 30 | 10 | 450 | 6.03 |
| 13 | 12 | 435 | 6.99 | 31 | 11.5 | 435 | 6.7 |
| 14 | 11.5 | 435 | 6.7 | 32 | 12 | 435 | 6.99 |
| 15 | 11.5 | 435 | 6.7 | 33 | 12 | 435 | 6.99 |
| 16 | 12 | 435 | 6.99 | 34 | 11.5 | 435 | 6.7 |
| 17 | 11.5 | 440 | 6.78 | 35 | 13. | 450 | 7.94 |
| 18 | 10 | 450 | 6.03 | | | | |

Total number of observations, 35. Duration of run, 8¾ minutes. Average of observations, 12.18 amperes, 436.8 volts, 7.1 electric horse power. Average speed, 2.78 miles per hour.

TEST 8.

| Observation. | Amperes. | Volts. | E. H. P. | Observation. | Amperes. | Volts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | [illegible] | [illegible] | 9.65 | 18 | 12 | 440 | 7.07 |
| 2 | 12.5 | 455 | 7.62 | 19 | 10 | 420 | 5.63 |
| 3 | 23 | 410 | 12.64 | 20 | 12.5 | 435 | 7.28 |
| 4 | 19.5 | 415 | 10.85 | 21 | 13 | 435 | 7.58 |
| 5 | 15 | 430 | 8.64 | 22 | 13 | 425 | 7.4 |
| 6 | 18 | 420 | 10.13 | 23 | 12.5 | 445 | 7.45 |
| 7 | 13 | 425 | 7.4 | 24 | 12 | 410 | 6.59 |
| 8 | 14 | 425 | 7.96 | 25 | 12 | 445 | 7.15 |
| 9 | 13 | 450 | 7.94 | 26 | 12.5 | 440 | 7.35 |
| 10 | 12.5 | 430 | 7.2 | 27 | 11.5 | 410 | 6.32 |
| 11 | 12.5 | 440 | 7.35 | 28 | 11 | 415 | 6.11 |
| 12 | 12.5 | 445 | 7.45 | 29 | 12.5 | 430 | 7.2 |
| 13 | 12 | 440 | 7.07 | 30 | 12 | 410 | 6.59 |
| 14 | 12.5 | [illegible] | [illegible] | 31 | 12 | 440 | 7.07 |
| 15 | 12 | 440 | 7.07 | 32 | 12 | 440 | 7.07 |
| 16 | 13 | [illegible] | [illegible] | 33 | 11 | 450 | 6.63 |
| 17 | [illegible] | 440 | [illegible] | 34 | 12.5 | 435 | 7.28 |

Total number of observations, 34. Duration of run, 8½ minutes. Average of observations, 13.22 amperes, 431.6 volts, 7.6 electric horse power. Average speed, 2.86 miles per hour.

TEST 9.

| Observation. | Amperes. | Volts. | E. H. P. | Observation. | Am. peres. | Tolts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | 10. | 460 | 6.16 | 19 | 13. | 450 | 7.84 |
| 2 | 22.5 | 375 | 11.31 | 20 | 12. | 440 | 7.08 |
| 3 | 16. | 375 | 8.04 | 21 | 12. | 455 | 7.31 |
| 4 | 17.5 | 435 | 10.20 | 22 | 13. | 455 | 7.92 |
| 5 | 20. | 380 | 10.19 | 23 | 12.5 | 430 | 7.20 |
| 6 | 17. | 445 | 10.14 | 24 | 13. | 440 | 7.66 |
| 7 | 15.5 | 440 | 9.14 | 25 | 12.5 | 455 | 7.62 |
| 8 | 14. | 420 | 7.88 | 26 | 11. | 450 | 6.63 |
| 9 | 12.5 | 410 | 6.73 | 27 | 11. | 425 | 6.26 |
| 10 | 14.5 | 455 | 8.84 | 28 | 11. | 445 | 6.56 |
| 11 | 13. | 440 | 7.67 | 29 | 12. | 450 | 7.23 |
| 12 | 12.5 | 425 | 7.10 | 30 | 13. | 435 | 7.58 |
| 13 | 13.5 | 440 | 7.96 | 31 | 13. | 450 | 7.84 |
| 14 | 13. | 440 | 7.66 | 32 | 12.5 | 430 | 7.20 |
| 15 | 12. | 440 | 7.08 | 33 | 10. | 425 | 5.69 |
| 16 | 12. | 440 | 7.08 | 34 | 13. | 440 | 7.67 |
| 17 | 12. | 430 | 6.91 | 35 | 12. | 450 | 7.23 |
| 18 | 13. | 435 | 7.58 | ...... | ...... | ...... | ...... |

Total number of observations, 35. Duration of run, 8¾ minutes. Average of observations, 13.3 amperes, 434.5 volts, 7.7 electric horse power. Average speed, 2.78 miles per hour.

TEST 10.

| Observation. | Amperes. | Volts. | E. H. P. | Observation. | Amperes. | Volts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | 10. | 460 | 6.16 | 19 | 16. | 375 | 8.04 |
| 2 | 13. | 440 | 7.66 | 20 | 11. | 450 | 6.63 |
| 3 | 20. | 380 | 10.18 | 21 | 15.5 | 440 | 9.14 |
| 4 | 22.5 | 375 | 11.31 | 22 | 13 | 440 | 7.66 |
| 5 | 12.5 | 410 | 6.73 | 23 | 13. | 440 | 7.66 |
| 6 | 17.5 | 435 | 10.20 | 24 | 13. | 455 | 7.92 |
| 7 | 13.5 | 440 | 7.96 | 25 | 12. | 440 | 7.07 |
| 8 | 14.5 | 455 | 9.94 | 26 | 12. | 440 | 7.07 |
| 9 | 12. | 430 | 6.91 | 27 | 13. | 450 | 7.94 |
| 10 | 17. | 445 | 10.14 | 28 | 13. | 435 | 7.58 |
| 11 | 12. | 455 | 7.31 | 29 | 12.5 | 430 | 7.2 |
| 12 | 14. | 420 | 7.88 | 30 | 12. | 440 | 7.07 |
| 13 | 12.5 | 455 | 7.62 | 31 | 11. | 425 | 6.26 |
| 14 | 12.5 | 430 | 7.2 | 32 | 13. | 440 | 7.66 |
| 15 | 12. | 450 | 7.23 | 33 | 13. | 550 | 7.94 |
| 16 | 13. | 435 | 7.58 | 34 | 12.5 | 425 | 7.1 |
| 17 | 10. | 425 | 5.69 | 35 | 10. | 425 | 5.69 |
| 18 | 11. | 445 | 6.42 | 36 | 12.5 | 430 | 7.2 |

Total number of observations, 36. Duration of run, 9 minutes. Average of observations, 13.2 amperes, 433.7 volts, 7.6 electric horse power. Average speed, 2.7 miles per hour.

TEST 11.

| Observation. | Amperes. | Volts. | E. H. P. | Observation. | Amperes. | Volts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | 11. | 450 | 6.63 | 19 | 12. | 440 | 7.07 |
| 2 | 12.5 | 455 | 7.62 | 20 | 12.5 | 435 | 7.28 |
| 3 | 12. | 440 | 7.07 | 21 | 12. | 440 | 7.07 |
| 4 | 19.5 | 415 | 10.85 | 22 | 13. | 425 | 7.4 |
| 5 | 12.5 | 430 | 7.2 | 23 | 12.5 | 440 | 7.35 |
| 6 | 18. | 420 | 10.13 | 24 | 12. | 410 | 6.59 |
| 7 | 11.5 | 410 | 6.32 | 25 | 13. | 450 | 7.94 |
| 8 | 14. | 425 | 7.96 | 26 | 12.5 | 440 | 7.35 |
| 9 | 12. | 445 | 7.15 | 27 | 13. | 425 | 7.4 |
| 10 | 12.5 | 430 | 7.2 | 28 | 12.5 | 435 | 7.28 |
| 11 | 12.5 | 445 | 7.45 | 29 | 15. | 430 | 8.64 |
| 12 | 12.5 | 445 | 7.45 | 30 | 12. | 440 | 7.07 |
| 13 | 13. | 435 | 7.58 | 31 | 23. | 410 | 12.64 |
| 14 | 12.5 | 435 | 7.28 | 32 | 12. | 410 | 6.59 |
| 15 | 10. | 420 | 5.63 | 33 | 18. | 400 | 9.65 |
| 16 | 13. | 450 | 7.94 | 34 | 11. | 415 | 6.11 |
| 17 | 12.5 | 440 | 7.35 | 35 | 12. | 440 | 7.07 |
| 18 | 12. | 440 | 7.07 | 36 | 12. | 410 | 6.59 |

Total number of observations, 36. Duration of run, 9 minutes. Average of observations, 13.1 amperes, 431.2 volts, 7.5 electric horse power. Average speed, 2.7 miles per hour.

TEST 12.

| Observation. | Amperes. | Volts. | E. H. P. | Observation. | Amperes. | Volts. | E. H. P. |
|---|---|---|---|---|---|---|---|
| 1 | 11.5 | 440 | 6.78 | 19 | 13 | 450 | 7.94 |
| 2 | 11.5 | 435 | 6.7 | 20 | 10. | 450 | 6.03 |
| 3 | 12.5 | 450 | 7.54 | 21 | 11.5 | 435 | 6.07 |
| 4 | 12. | 435 | 6.99 | 22 | 12. | 425 | 6.7 |
| 5 | 12. | 430 | 6.91 | 23 | 12. | 435 | 6.99 |
| 6 | 10. | 450 | 6.03 | 24 | 18. | 410 | 9.89 |
| 7 | 10 | 435 | 5.83 | 25 | 12.5 | 455 | 7.62 |
| 8 | 12. | 440 | 7.07 | 26 | 15 | 430 | 8.64 |
| 9 | 9. | 415 | 5 | 27 | 13. | 450 | 7.94 |
| 10 | 12. | 435 | 6.99 | 28 | 13.5 | 440 | 7.96 |
| 11 | 12. | 435 | 6.99 | 29 | 13. | 425 | 7.4 |
| 12 | 10. | 450 | 6.03 | 30 | 13. | 445 | 7.75 |
| 13 | 12.5 | 455 | 7.62 | 31 | 15.5 | 420 | 8.72 |
| 14 | 12 | 435 | 6.99 | 32 | 12. | 455 | 7.62 |
| 15 | 11.5 | 435 | 6.7 | 33 | 15. | 430 | 8.64 |
| 16 | 12. | 440 | 7.07 | 34 | 11.5 | 435 | 6.7 |
| 17 | 12. | 435 | 6.99 | 35 | 15. | 430 | 8.64 |
| 18 | 12. | 435 | 6.99 | | | | |

Total number of observations, 35. Duration of run, 8¾ minutes. Average of observations, 12.3 amperes, 437.2 volts, 7.2 electric horse power. Average speed, 2.78 miles per hour.

SUMMARY OF OBSERVATIONS.

| Test No. | Duration in minutes. | Distance in miles. | Average E. H. P. | E. H. P. × minutes ÷ 60 = E. H. P. | Average speed in miles per hour. |
|---|---|---|---|---|---|
| 1 | 11.75 | 0.4062 | 9.5 | 1.86 | 2.07 |
| 2 | 11.5 | 0.4062 | 10.8 | 2.07 | 2.12 |
| 3 | 10.5 | 0.4062 | 9.3 | 1.62 | 2.32 |
| 4 | 10.5 | 0.4062 | 9.2 | 1.61 | 2.32 |
| 5 | 10.75 | 0.4062 | 8.5 | 1.52 | 2.26 |
| 6 | 9.75 | 0.4062 | 9.4 | 1.52 | 2.5 |
| 7 | 8.75 | 0.4062 | 7.1 | 1.03 | 2.78 |
| 8 | 8.5 | 0.4062 | 7.6 | 1.07 | 2.86 |
| 9 | 8.75 | 0.4062 | 7.7 | 1.29 | 2.78 |
| 10 | 9 | 0.4062 | 7.6 | 1.14 | 2.7 |
| 11 | 9 | 0.4062 | 7.5 | 1.12 | 2.7 |
| 12 | 8.75 | 0.4062 | 7.2 | 1.05 | 2.78 |
| Totals | 117.5 | 4.8744 | | 16.9 | |

Total duration of runs = 117.5 ÷ 60 = 1.96 hours.
Mean power applied = 16.9 ÷ 1.96 = 8.6 E. H. P.
Mean speed attained = 4.8744 ÷ 1.96 = 2.48 miles per hour.

## Another Reason for Burying Wires.

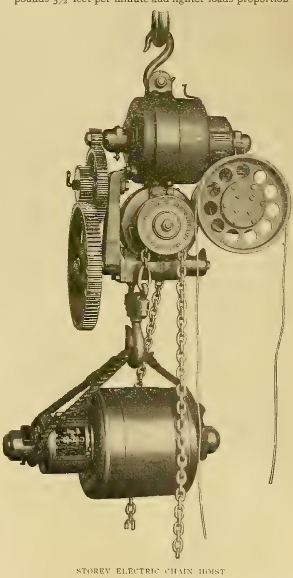
[From the Rochester *Union and Advertiser*.]

Several thousand patents relating to electricity are granted every year, and yet nobody has thus far invented an electric lineman who can ascend a pole gracefully.

## Storey Electric Chain Hoist.

In the average shop where belting is employed there is a loss of at least 50 per cent. between the power generated and that which is available for the operation of the tools. Many persons would no doubt contradict this statement, but careful tests prove it to be true. What a contrast is presented in the equipment of factories using electric motors!—a strange absence of shafting, belting and pulleys; instead, small motors directly connected to the different tools, making an equipment not only neater in appearance and one where there is less danger to employes, but also one that is far more efficient—where, when a tool is stopped the coal pile is effected, not the nearest countershaft.

One of the many moves in the line of direct-connected apparatus is shown in the chain hoist herewith illustrated, which is a very useful piece of machinery, especially in electric light and power stations, iron and steel foundries, factories, etc., and for handling heavy freight. This is one of the products of the Storey Motor & Tool company of Philadelphia, and the type illustrated is of 10,000 pounds capacity. This hoist is operated by a five horse power motor and will lift 10,000 pounds 5½ feet per minute and lighter loads proportionately faster. It will lower at the rate of 10 feet per minute. By means of the reversing controlling box which comprises a part of the apparatus the hoist will raise and lower anywhere within the above speeds at will of the operator. The starting, stopping regulating and reversing of the motor are controlled by the two ropes shown in the picture, which are connected to a wheel on the reversing rheostat, which is automatic in its action, the current being cut off as soon as the rope is released.



STOREY ELECTRIC CHAIN HOIST

## City Electrician Advocated by the Mayor of Buffalo.

In his annual message, submitted to the Common Council on Monday, January 6th, Mayor Jewett of Buffalo said:

Electricity is becoming so potent a factor in civilized life and figures so conspicuously in municipal problems, that it seems to me that it would pay the city to employ an electrical expert, to be appointed by the Board of Public Works and known as the city electrician. He should have charge of all electrical wires in the public streets and superintend the construction of all new electric lines, particularly those for the transmission of Niagara Falls power, and all new street railroad lines. It should be his duty to see that all proper precautions are taken to prevent the destruction by electrolysis of the

water and gas mains now in the streets. The damage from this cause has been very large in some cities, and the authorities of Buffalo ought to be on guard to prevent a similar occurrence here. Plenty of work could be found for a city electrician to do, and I believe the creation of such an office would be a wise and desirable step.

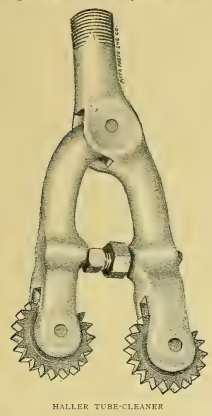
## Northwestern Electrical Association.

This week's convention of the Northwestern Electrical association at the Hotel Pfister, Milwaukee, promises to be an instructive gathering. In addition to the general business of the meeting, these papers will be read, among others. "Modern Apparatus and Existing Conditions," by W. J. Buckley; "Economic Expression for Fuel Value," by Arthur Vaughn Abbott; "Storage Batteries in Central Stations," by Maurice Barnett; "Some Facts about Acetylene Gas," by John C. McMynn; "Power Transmission Plants," by E. R. Cunningham; "The Upbuilding of a Small Town," by Fred De Land. A large Chicago delegation will be in attendance.

## Haller Tube Cleaner.

This device, designed for cleaning the tubes of boilers, is manufactured by the McClain Manufacturing company of Fittsburg. It is the invention of a practical engineer, and is claimed to be the best appliance of the kind in the market.

The body of the cleaner is made of cast-steel and the cutting wheels of the best tool steel. All the parts are interchangeable, and should any one of them become



HALLER TUBE-CLEANER

broken or injured in any manner, it can easily be replaced. One of the features of this machine, to which particular attention is directed, is the set screw, by means of which the jaws are regulated. This is a feature not possessed by any other tube cleaner, it is said. The set screw prevents the jaws from contracting, and a passage must be cut through the deposit before it can possibly go any farther. Any engineer who has ever used a tube cleaner can appreciate the advantage there is in having a machine which will not pass readily over obstructions. No injury can be done to the tubes, because the machine is set a size smaller than their inside diameter, and no pressure will be exerted except where there is a coating of scale between the cutting wheels and side of the tube.

## What Might Have Been!

[From the New York *Sun*.]

A commission has been appointed for the purpose of studying the question of illuminating the Hellespont with the electric light. It is no romantic substitute for poor Hero's lamp, but Leander might have lived to a good old age if he had only had the benefit of it. And the fair Helle herself, who gave her name to the since somewhat well-known piece of water, might have been able to pick up a life preserver if the sea had been properly lighted, and so have escaped a wet death and immortality.

The stenographic report of the 14th annual convention of the American Street Railway association at Montreal October 15–18, 1895, is out. It is a well arranged and well printed volume of 278 pages, with a steel engraving of ex-President Hurt as a frontispiece. Secretary Pennington is to be congratulated on his promptness and editorial skill.

## A Contrast in Enterprise.

We sincerely regret to learn that the printing-office of our esteemed contemporary, the WESTERN ELECTRICIAN, was burned out on Monday of this week. The issue of the paper for the current week may be slightly delayed. The hustling abilities of our western friends will doubtless be equal to the emergency. With such a valid excuse, even a week's delay in the delivery of the WESTERN ELECTRICIAN would be pardoned by its readers. But the Postal Telegraph building at 253 Broadway, New York city, still stands—and yet the *Electrical World* for last week has not been issued as we go to press. Has our ten-green contemporary at last taken pity on its few paying subscribers and allowed them a temporary respite?—*Electrical Review*, January 8th.

[The distinction made by our esteemed contemporary is further emphasized by the fact the fire delayed last week's issue of the WESTERN ELECTRICIAN but one day. —ED.]

# CORRESPONDENCE.

## New York Notes.

NEW YORK, January 11.—Considerable attention has been attracted by the decision of Justice Ingraham of the Supreme Court in the telephone case of Simon Sterne. The temporary injunction which Mr. Sterne obtained a year ago preventing the Metropolitan Telephone & Telegraph company from removing the telephone from his office has been made permanent by the judge, pending the action brought for the same relief. The plaintiff is required to give a bond to secure the company from loss of rents and damage, if it should ultimately be decided in the action that he was not entitled to the injunction. The action is a test case, and mainly turned on whether the company has the right to fix rates arbitrarily, or whether it is a common carrier which must take business at such rates as the courts, in the absence of legislative direction, shall hold to be reasonable. Until October, 1894, Mr. Sterne had a telephone service at $125 a year, but in that month he and other subscribers were notified that owing to improvements in the service they must call and make new contracts for $240 a year. Mr. Sterne disregarded the threats of the company to remove his old telephone unless he signed a contract for the higher rates. When the company finally set a day for him to sign or have the telephone removed, he procured the temporary injunction from Justice O'Brien. Owing to the importance of the case, it was argued very fully last February, and Justice Ingraham had since then reserved decision, having to wait a large part of the time for briefs of the counsel. In his opinion the judge said: "I am inclined to think that this duty of the courts extends to a a business carried on under the authority of law which is in its nature a public business 'affected with a public interest,' and that the transmission of intelligence by electricity is a business of such a public character that it is to be exercised under public control." The question of reasonable compensation is held in abeyance until the action is tried and witnesses are examined.

Experiments have been made in the line of telephoning to moving trains on the Brooklyn bridge from the office of Train Dispatcher Prince at the Brooklyn end of the structure. A conversation was carried on all the way over, and the train was stopped within 14 seconds after Mr. Prince had ordered a danger signal hoisted. Superintendent Martin says he will recommend the trustees to adopt the system.

Speaker Fish has announced the following Assembly committee on electricity, gas and water supply: Messrs. Lounsberry of Ulster, Braun of Erie, Cutler of Rockland, Goodsell of Orange, Brownell of Broome, McNaughton of Saratoga, Taylor of Oswego, Messiter of Sullivan, Forester of Kings, Cole of Wyoming, Finn of New York, McKeown of Kings, Corrigan of New York.

Over in Jersey they are having a lively discussion of telephone rates and service. The Orange Common Council, the East Orange Township Committee and the South Orange Village Board of Trustees are considering ordinances granting to the New York & New Jersey Telephone company the right to construct underground conduits for its wires. The ordinances correspond in construction, and each one of the governing bodies seems to be waiting for some other to take action. It is contended that the company's object is simply to make more secure its present monopoly and to compel people to take the long-distance or metallic circuit service at an increased cost. It is also asserted that the company charges its patrons in the Oranges from $75 to $130 a year, while it furnishes similar service to Newark customers for $60 a year. The alleged great profits of the telephone company have given rise to the formation of competing companies, and one of these, known as the Orange Telephone company, was incorporated last week. It has already applied for a franchise in East Orange, and will present similar proposals to the governing bodies of the other Oranges. It is understood that the Orange Telephone company will act in harmony with the Newark Telephone company, recently incorporated.

Expert testimony has been adduced this week before the Special Rapid Transit Commission of Inquiry to prove that Chief Engineer Parsons' estimates for the underground lines are too low. J. F. O'Rourke, an experienced engineer, gave an estimate of total cost of $80,500,000, or $39,500,000 more than Mr. Parsons' estimate. Other engineers did not consider this an excessive estimate. The hearing was adjourned until Monday.

Electric transparencies, carried about on the shoulders of men, have made their appearance in this city. The transparency is about three feet high by two feet wide, and on its face extols the merits of the wares of the advertiser. Within are four incandescent electric lights with red, blue, green and white globes. A storage battery strapped about the waist of the bearer of the device, furnishes the illuminating power, and as he walks along he in turn lights and extinguishes each of the lamps, the result being a novel effect of rapidly changing colors.

W. F. O.

## Washington, D. C.

WASHINGTON, D. C., January 10.—A bill to permit the Home Telephone company of this city to install, maintain and operate a telephone plant and exchange in the District of Columbia has been introduced into the House by Mr. Wellington. The rates to be charged by the company shall not at any time be more than $30 per year for residences nor more than $42 per year for business houses in the city of Washington, and such additional sum for service in the District, outside of the city, as may be approved by the commissioners of the District, and the various departments of the District of Columbia and executive departments of the United States shall not be charged more than the rate of $18 per telephone per year for service within the city of Washington, and such additional amounts for services in the District outside of the city as may be approved by the secretary of the interior.

Mr. White has introduced into the Senate a bill granting to the Kern River & Los Angeles Electric Power company a right of way over, and reservoir and building sites in, the reservation established by the president by proclamation No. 38, dated December 20, 1892, and also a right of way over, and reservoir building sites in, the reservation established by the president by proclamation No. 43, and dated February 14, 1893, and in and over vacant public lands. It is desired that it be enacted that a right of way 200 feet wide be granted to the company for the construction, erection and maintenance of a line or lines for the electrical transmission of energy from a point on Kern river, in the county of Kern, state of California, to a point in the county of Los Angeles, state of California, and thence through various townships to range 14 west, San Bernardino meridian. The company is to have the right to use such timber, stone, earth or other material as may be necessary to construct, erect or maintain the said lines, and to fell such timber as may be necessary to protect the poles and wires of the company. It is further asked that the company be granted right of way for such canals as may be from time to time necessary for the purposes of the company, and that it be allowed the right to appropriate and use any and all water for its purposes from the Kern river and other rivers and streams not otherwise appropriated at the time of the passage of this act. Also, it is provided that the company shall not assign or transfer or mortgage the rights granted for any purpose whatever until the completion of its works, when possessed of the ability to deliver at the city of Los Angeles, state of California, electrical power equivalent to 5,000 horse power. The rights granted shall be lost and forfeited by the company if the amount of electric power equivalent to 5,000 horse power be not ready for delivery at the city of Los Angeles within five years from the passage of the act.

Eight trolley roads are in operation about Washington, and all these roads are soon to be connected by the line of the Potomac Power & Light company from Newark street on the Tenley town road, which this company owns, by way of Sherman avenue and the Soldiers' Home, to the power house on the Brentwood road east of Eckington. On the other side of the river the Wash-

ington, Alexandria & Mount Vernon road has come up from the tomb of Washington, and, skirting the northeast side of Arlington cemetery, has begirt the city on the south and west from Alexandria to Rosslyn. Even now this company is seeking to get a foothold at the river front on Fourteenth street, southwest, with every prospect of success. The Washington, Arlington & Falls Church road has recently started its cars again to Fort Myer, and it is only waiting a little delay in the courts till it shall reach across the Aqueduct Bridge and connect its trolley system with that of the Potomac Power & Light company, which is supposed to have behind it the influence of ex-Secretary William C. Whitney. N. C.

## News From Niagara Falls.

NIAGARA FALLS, N. Y., January 10.—It is officially announced that a contract has been made between the Niagara Falls Power company and Walton Ferguson of New York city, under the terms of which Mr. Ferguson will immediately build a factory on the Power company's lands for the production of chlorate of potash. The site has been selected and is located about 200 feet to the east of the new calcic carbide plant. Like all the other factories built and building, it is located on the line of the Junction railway, and includes one acre of ground, with an option to increase. The plant is to be erected at once. The first delivery of power will be 500 horse power, the contract calling for an additional amount up to 3,500 horse power. This makes four factories under way on the Power company's lands, and more contracts are under consideration and likely to be announced any day.

The bids which the Niagara Falls Power company has asked for the extension of its wheel-pit are to be filed in the company's office, Mills building, New York, on or before the 13th instant, at which time the proposals will be considered and the contract awarded. The work will cost fully a million dollars.

New Year's Day brought Ricardo Zuloaga of the "Compania Anouima La Electricidad," Caracas, Venezuela, to this city to inspect the big power plant and method of power development at Niagara. Mr. Zuloaga's visit was not one of idle curiosity. On the contrary, he came representing the Venezuelan company mentioned for the purpose of ascertaining the best method of development of 3,000 horse power at the Falls of St. Encantada, the power to be transmitted from there to Caracas, a city having a population of about 100,000 inhabitants. At the point where it is expected to develop this power, Mr. Zuloaga stated, there are two falls, each quite high but not of great volume. These falls are formed by the El Guaire river. One is 120 feet high and is located about 10 miles from Caracas, while the other is 225 feet in height and 12 miles away from the city that expects to be benefitted by the project. It is expected that the first fall will develop about 1,000 horse power, and that the other will give at least 2,000 horse power. In the development of this power a canal would be used, the plan being something of the nature of the Niagara Falls Hydraulic Power & Manufacturing company's plant at Niagara; therefore no tunnel would be necessary. Electricians who contemplate going to Venezuela to get the contract for this plant or any part of it will be interested in Mr. Zuloaga's statement that "a man can live very comfortably in my country on about $135 a month; that is, if he is a single man." On his visit at Niagara Mr. Zuloaga was accompanied by W. B. Wreaks, who is the New York agent of the Westinghouse Electric & Manufacturing company of Pittsburg.

The new building of the Carborundum company is going up rapidly, and this company will soon be making all its goods at Niagara. O. E. D.

## Detroit, Mich.

DETROIT, January 11.—A careful survey of the electrical field in this locality reveals the fact that business is in better condition than usual at the beginning of the year. Every one is occupied with work, and some of them are rushed. Of the class mention should be made of the Detroit Electrical Wiring & Repair company. It has under way work at the Central High School, the Union Trust building, Children's Free Hospital and the Public Library. The High School installation comprises a combination system of electric light wiring. The original plan was to have brass armored conduits. It is quite probable, however, that iron-armored conduits will be used. There are to be installed motors, storage battery, self winding clocks, a telephone system, call bells, and electric light fixtures. The plant at the Children's Free Hospital comprises two direct-connected dynamos and an engine. The wiring will be an iron conduit system. The work at the Union Trust building is electric light wiring, both brass-armored conduits and Circular Loom tubing. The Public Library work is electric light wiring in brass-armored conduits. This firm has the agency for the Siemens & Halske machinery.

The Michigan Electric company is likewise having a successful season. One of its latest accomplishments is the installation of an electrically illuminated sign for the J. L. Hudson company. The sign was designed by Joseph E. Lockwood, president of the Michigan company, and was built by the Edison decorative and miniature lamp department of the Edison Lamp Works. It is not an exaggeration to say that the sign installed for the Hudson company is surpassed by none in the country. This sign, 60 feet in height, makes prominent the word "Hudson." It has two sets of lamps, and may be seen for a long distance from either direction. The letters are four by six feet with eight-inch face, and contain a total of 360 20 candle power Edison lamps. The mechanical features of the sign are well worth the study of anyone interested in that kind of decoration. The Michigan company is agent in Detroit for the General Electric company's goods.

The serious accident known as the *journal* building boiler explosion, which occurred here some weeks ago, has created among a great many the impression that there is no safety in any high-pressure steam apparatus. Detroit's mayor is of that class, and with him the opposition to high-pressure boilers has become so strong that he has attacked the Board of Education, and is attempting to prevent the installation of an independent lighting plant in the Central High School building. The board had the advice of the best electrical engineers and was likely to succeed in spite of His Honor's opposition, but Detroit's mayor will not give up easily; in fact, the natives doubt if he was ever fully persuaded of personal defeat. His latest move consists in securing the adoption of ordinances requiring that all public buildings, including schools, in which electric lighting is used, be furnished with current by the Public Lighting Commission, and prohibiting the use of steam boilers carrying more than 10 pounds pressure in public school buildings or grounds. This action on the part of the mayor and the Common Council at first appears to be a complete defeat for the school board, but with such an example as that of the mayor to teach fighting qualities, the board has made some advance in that line, and does not propose to give up the fight at this point. It has employed able counsel to assist its attorney and proposes to have the courts decide on the ordinances. It is reported that a further move on the part of the mayor's forces will be to cut down the appropriation so that the school board will not be able to run an independent plant. The outlook is certainly an encouraging one for the space writer and the lawyers, and of course an interesting topic of conversation for the friends of both sides. C.

## Northwestern Notations.

MINNEAPOLIS, January 11.—The receiver for the General Electric company of Winona, Minn., contemplates discontinuing some of the street car lines and using the material made available to extend the line in other directions.

Applications will be made to the councils of Pierre and Fort Pierre, S. D., for a franchise for street cars to connect the two cities.

The electric light company at Chamberlain, S. D., has just completed an artesian well eight inches in diameter and 690 feet deep. Its flow is estimated at 4,000 gallons per minute, or nearly 6,000,000 gallons every 24 hours.

The electric light plant at Storm Lake, Ia., was partially destroyed by fire.

The Brainerd Traction, Light & Power company has been incorporated. This is the outgrowth of the recent vote of the city of Brainerd, Minn., to sell its electric light plant to C. N. Parker. This company will expend $10,000 to $15,000 on improvements at the lighting station. The new company will control the Brainerd Electric Railway company, the electric light plant, the water power and the telephone system.

The city of Bedford, Ia., recently granted a fifteen year franchise for an electric light plant.

Work has been pushed for the Central Wisconsin Electric Railway company at Oshkosh, Wis., despite its numerous legal troubles. Charles W. Felker has made application to the attorney-general to annul the charter of the Central Electric company, and it is understood that it is at the instance of the Oshkosh Street Railway company. The Real Estate Board has unanimously passed a resolution condemning the action of Felker and the Oshkosh Street Railway company in vigorous terms, and has asked the attorney-general, before he makes any decision in the matter, to visit Oshkosh and make a thorough investigation.

The Twin City Rapid Transit company is about to equip its cars in St. Paul with fenders. Fenders have been in use on a number of cars in Minneapolis for some time, but have not as yet had any better tests than scooping up dogs that have got in the road.

Miss Lillian J. West was recently married to Dow F. Smith of St. Paul, who is connected with the Twin City Rapid Transit company. Mr. Smith has been superintendent of the St. Paul system and nominal superintendent of the Minneapolis system for some time, but has recently been relieved of the Minneapolis department.

Elihu Colman has been granted a first lien on the plant of the Light, Power & Railway company of Fond du Lac, Wis., in order to buy meters and other needed improvements.

Prof. Shepardson's report on the electrical equipment of the new court house at Minneapolis shows nearly everything up to requirements. Experts have been engaged in making tests of the electric elevators for some time, and it is understood that, in the main, the results have been satisfactory. The fear that attempts have been made to interfere and damage the machinery of the elevators has led the Sprague Electric Elevator company to offer a reward of $100 for the arrest and conviction of any person making such attempts.

The Electrotechnic club has been formed in Minneapolis by electrical engineers and those engaged in allied work.

The City Council of Jamestown, N. D., has ordered the street lights shut off for an indefinite period. It is proposed to put in a municipal electric light plant and secure power from an artesian well.

The backers of the proposed Milwaukee, Racine and Kenosha electric line have applied for a franchise through Kenosha, Wis.

The People's Light company secured a contract to light the city of Davenport, Ia., at a reduction of $19 per light from the present figure, which is $75 per year. The acceptance of the contract carries with it an agreement to put in a gas plant and heating plant.

A. C. Bachelor, a stockholder in the Tower, Minn., Electric Light & Telephone company, has sued Geo. H. Claypool and E. C. Jones of Duluth, claiming that they are managing the affairs of the company for their own benefit, and that they have misappropriated $9,000. Among other things he charges that the books have been kept falsely. He wants the defendants restrained from paying out of the company's funds claims which they have against it, and also asks for a receiver.

The Northfield Light, Heat & Power company of Northfield, Minn., has moved into its new building.

J. S. Bartholomew of Grand Forks, N. D., has purchased the electric light plant at Aberdeen, S. D., and will make a number of improvements in it.

Chas. Hinman proposes to put in an electric light plant at Bellevue, Ia.

The Arcadia Milling company of Arcadia, Wis., will have an electric light plant in working order by February 1st.

The Lincoln, Neb., Electric Light company proposes to purchase the Hastings, Neb., plant and interest local capital in it.

The Beatrice Light company of Beatrice, Neb., has offered to furnish light to the city for a price which the council proposed in November and the company then rejected. An ordinance will be introduced to put an occupation tax on all telephone and telegraph poles in the streets or alleys.

The Green Bay, Wis., council has refused a franchise to David McCartney to extend an electric road on the West Side, and some of the disappointed people of Green Bay say that the rival company's stockholders control the council.

The Combination Bridge company of Sioux City, Iowa, now controls a majority of the stock of the South Sioux City Traction company.

Private parties have made arrangements to continue the electric light plant at Watertown, S. D., which was to have shut down January 1st, owing to insufficient patronage. Flax straw will be used for fuel which will materially reduce expenses.

It is understood that the report of the Board of Public Works of St. Paul on lighting the city will recommend electricity by contract.

It is understood that the North American Telegraph

company will establish an office in Red Wing, Minn., making connection from Hager City, Wis. C.

## PERSONAL.

James J. Wood and C. C. Miller of the Fort Wayne Electric corporation, Fort Wayne, Ind., were in Chicago last week. They were accompanied by F. W Lankenau of Plymouth, Ind.

Walter A. Geft has assumed the eastern agency of the *Journal of Electricity* of San Francisco, with headquarters in Chicago. Mr. Geft is an experienced newspaper man and will worthily represent Mr. Low's paper in the eastern and central states.

Isaac L. Rice, chairman of the executive committee of the Electric Storage Battery company of Philadelphia, is in Chicago. Mr. Rice is at the head of the syndicate that has purchased the Englewood & Chicago street railway franchise for a storage battery road.

Friends of J. S. Tebbets, manager of the Chicago agency of the Westinghouse Electric & Manufacturing company, will doubtless be surprised to learn that he has resigned the management of the Chicago district to accept a position with George Westinghouse, Jr. Maurice Coster, who has heretofore been engineer and agent in connection with the Chicago office, has been promoted to fill the position left vacant by Mr. Tebbets.

## ELECTRIC LIGHTING.

J. D. Bennett of Brooklyn has been appointed receiver of the Rockaway Electric Light company. The liabilities are $100,000 and the assets $15,000.

The introduction of the electric light for the purpose of facilitating the navigation of rivers in India, has, says the Calcutta *Englishman*, been a complete success. It was introduced by the River Steam Navigation company, with a view to expedite the journeys of their vessels down from Goalundo to Calcutta, through the broad reaches of the Sunderbunds, during the night time. The advantage of the system has been abundantly proved during the voyages of the steamers Nagpur, Gwalior, Ajmere and India, each of which towed two barges with an average combined load of 80,000 drums of jute between the two. Under the older system the run from Goalundo to Calcutta occupied nine days, and even more sometimes; but since the introduction of the electric light the cargoes have been in Calcutta in four days in two instances, and within five days in the others—a very substantial saving of time and cost.

## ELECTRIC RAILWAYS.

At a meeting of the stockholders of the New Orleans Traction company, held January 6th, in which 60,594 shares out of 75,000 were represented, the following board of directors was elected: A. Baldwin, C. H. Hyams, R. M. Walmsley, J. C. Denis, James H. Maury, Frank T. Howard, John D. Taggart. At a subsequent meeting of the board the following named officers for the ensuing year were elected: James H. Maury, president; R. M. Walmsley, vice-president; Henry Seligman, secretary and treasurer; A. H. Ford, assistant secretary and treasurer.

The annual meetings of the Northwestern Elevated road and of the Columbia Construction company, Chicago, were held last week. The official estimate of the cost of the entire elevated road, a little over seven miles in length, is $7,290,000; but the company expects to save a large sum, from $300,000 to $900,000, in salvage through the sale of real estate purchased, but not needed, and of buildings on the right of way bought and removed. It is stated officially that the company sees its way to the completing of the road without any increase in its capital. Of the Northwestern Elevated bonds first issued about $800,000, it is said, were used as collateral, but these will be retired and cancelled from the proceeds of the preferred stock, so that no bonds will be outstanding. The directors of the Northwestern Elevated elected were: D. H. Louderback, L. S. Owsley, E. W. Sherman, J. L. Cochran and Howard Abel. The directos of the Columbia Construction company elected were: George A. Yuille, J. William Helm' W F. Furbeck, E. E. Prussing, William Dickinson

## TRADE NEWS.

The Metropolitan Electric company, Chicago, is sending out samples of motor cloth for motor curtains, for which the claim is made that it is very strong, is waterproof and is pliable and elastic.

A D Sill, Elgin, Ill, manufacturer of telephones, transmitters, etc, is far behind in his orders. The fact that purchasers duplicate previous orders speaks well for the transmitter manufactured by Mr Sill.

It is a pleasure to note the progress which has been made by Huebel & Manger of Brooklyn, N. Y., who have recently doubled their force of men in order to meet the requirements of the rapid increase in their business, and taken extra room in order to place new machinery. They have arranged for a much larger production of their various styles of pivoted armature iron frame bells and other electrical goods.

The Emerson Electric Manufacturing company of St. Louis is receiving numerous inquiries regarding its new alternating power motors. Although recently placed on the market, these motors are proving to be all that is claimed, and the guarantee of the Emerson company is ample assurance to the trade of any article turned out by it. This company is adding to its already large facilities and will make the power motors a leading feature among its various specialties.

The partnership heretofore existing between J. Grant High, George T. Eyanson and Cyrus C. Armpriester was dissolved on December 17, 1895, by the withdrawal of J. Grant High, his whole share of the rights, title, interest and good will having been purchased by George T. Eyanson. The business will be conducted as heretofore, Mr. Eyanson attending to the construction, as he has been doing for the last two years. His success in building switches and switchboards should insure the future success of the new firm.

The second directly coupled 800 kilowatt monocyclic generator built by the General Electric company has been started successfully in the St. Louis station. This machine, like its mate, which has been operating for some time in that station, is so large that it was impossible to assemble it at the works before shipment. These machines are now operating successfully incandescent lamps, arc lights and motors in the city of St. Louis. A model was shown at the Atlanta exhibition, for which some very attractive printed material was also issued.

It is not an uncommon sight for shivering pedestrians along Chicago's busy thoroughfares to see the shining blades of a Lundell motor-fan whirling away in many large show windows, seemingly for no other purpose than to keep in practice. However, this is not the reason, as a very practical object is in view. Some thoughtful window dresser discovered that the breeze from one of these fans would keep the large plates of glass free from frost. However beautiful the frost crystal really is, the window dresser does not admire it in the wrong place, particularly after making an elaborate and expensive display. The Lundell fan breeze, turned against the glass, immediately clears it of frost and vapor. The philosophy of this may be left for the reader to figure out. The Central Electric company of 173 Adams street, Chicago, is figuring it out now in a very acceptable manner, having sold a large number of Lundell fans during and since the holidays.

## BUSINESS.

The Eureka brazer of the Union Heater Supply company of Detroit is operated by gasoline, and is so constructed that the heads can be adjusted, permitting the flames to be placed just where the heat is required. Five hundred of these brazers were sold the first year they were out.

The National India Rubber company of Bristol, R. I., is very busy in its electrical department, and is particularly rushed in the cable room, having secured a very large and important N. I. R. cable order. The company has completed extensive additions and improvements and is better fitted to execute orders than ever before. It has a new catalogue in press, which will be sent to customers as soon as issued. The company will also be pleased to send a copy to anyone sending his address

MacCurdy & Smith of Indianapolis are pushing the sale of Phœnix rubber insulating paint This paint is said to be manufactured from a newly discovered mineral that is extremely rich in natural oil It contains no crude asphalt, tar or other deleterious substance, it is claimed, and is a strictly first-class insulating paint, for armatures, fields, switchboards, conduits, iron and wood poles, connections, mouldings, wires, cut out boxes, lamp hoods, and all other kinds of electrical appliances where high insulation is desired

General Manager C. H. Brigham of the Boynton Multivolt Battery company, New York, reports that the business of this concern has increased to such an extent that it is found necessary to establish an office at 169 Greenwich street, New York, as many customers desire to save the time of going to the Brooklyn office The battery which this concern manufactures has created a widespread interest in the electrical trade on account of the very strong statement regarding its voltage. The large number of orders that have been duplicated give strong testimony to show the worth of the battery.

Eugene Munsell & Co., 218 Water street, New York, with agencies in the principal cities, report an increased demand for solid sheet India and amber mica, of which they make a specialty for electrical insulation. They import directly from the mines, and at all times carry what is said to be the largest stock of mica to be found in this country. They have recently installed several new power presses, which give them increased facilities for furnishing stamped solid sheet mica segments for all types of railway motors, and mica to any shape or pattern. Franklin Brooks, the junior member of the firm, is now making a tour around the world, and, at the present time, is spending considerable time at the mines in India, where the firm is largely interested.

The Hayes, Tracy, Fyfe company, 360 Dearborn street, Chicago, is receiving favorable indorsement from motor makers and users of the Fyfe motor starting and motor speed regulating rheostats. The device thoroughly protects the motor armature from overload and is automatic in release. Those having double-pole switch attachment are an extra safeguard against accident to motor from outside causes, such as lightning and the like, when the works are closed, as the motor is entirely cut off from the mains. The action of the switch is positive, and, when closing, throws the field in circuit just ahead of the armature and throwing the armature out just ahead of the field by the automatic falling of the contact arm. The motor speed regulating rheostats are novel, inasmuch as they are automatic in release from each step of the resistance. City authorities and boards of underwriters have been unanimous in pronouncing the apparatus entirely satisfactory. Among the points appreciated is the absence of fine wire magnets to make the action unreliable. The mechanical construction and fireproof qualities are everything that can be desired.

The works of the Pittsburg Reduction company have now been in operation at Niagara Falls for several months. The necessary electric current has hitherto been furnished through four of the General Electric company's 400 kilowatt rotary converters, but owing to a considerable increase in the reduction plant, they have been found inadequate for the service, and each of these 400 kilowatt converters is about to be replaced by one of 600 kilowatts capacity. The new machines will be mounted upon the same base frames as the 400 kilowatt converters, and thus the converter plant will be increased one-half without any increase in floor space. A fifth converter of 600 kilowatts capacity will be installed beside the others and will be similar to them in every respect. The total rotary converter capacity will then be 3,000 kilowatts. Including the transformers installed in the works of the Carborundum company and the Calcium Carbide company at Niagara Falls, the General Electric company will have furnished 5,000 kilowatts capacity of transformers for operation in connection with the Cataract Construction company's system.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued January 7, 1896.*

552,371. Method of and Apparatus for Measuring Illumination. Edwin J. Houston and Arthur E. Kennelly, Philadelphia, Pa. Application filed February 13, 1895. (*Issued December 31, 1895.*)

The method consists in definitely diffusing the effective light in a given region by means of a secondary illuminator, exposing a test object in definite relation to the diffused secondary illumination only, definitely obscuring the test object to the limit of visibility, and comparing with a standard that condition of illumination of the test object which corresponds with the limit of visibility of the test object.

552,516. Telephone Switch. George W. Coy, Milford, Conn. Application filed March 15, 1895.

A transmitting apparatus is mounted to move in a fixed path, and switching levers mounted independently of the transmitter and its support, and located adjacent to each other in the path of movement of the transmitting apparatus to be operated by the insertion thereof between them.

552,521. Electric Motor. Stephen D. Field, Yonkers, N. Y. Application filed June 27, 1892.

One feature claimed is the method of controlling the circuit of a shunt wound motor, which consists in automatically rotating the field of the motor, and thereby varying the resistance to the armature of the motor.

552,540. Electric Meter. William H. McGrath, Fort Wayne, Ind., and John M. Oram, Dallas, Tex. Application filed July 8, 1895.

A rotating switch is employed for cutting the translating devices in and out of circuit, together with a recording time piece, including a motor-driven train of wheels, a flexible, vibratory spring having a free terminal in position to engage a wheel of the train, and a rotating cam mechanically connected to the switch in position to engage the spring and force it into contact with a wheel when the cam is at one point of rotation, and to release the spring upon a further movement.

552,542. Apparatus for Protecting Electrical Circuits John M. Oram, Dallas, Tex. Application filed June 4, 1895.

At one station there are an electric circuit, including an alarm or indicator, a relay having circuit closing points, a second circuit closer in the circuit, an automatic signal transmitter to operate the circuit closer, a main circuit containing the coils of the relay, and at a second station an artificial resistance, a circuit closer to cut in and out the resistance, and an automatic signal transmitter to operate the circuit closer.

552,553. Phase Completing Device James T. Sibley, Clinton, Canada. Application filed March 28, 1893

This device is provided with an actuating arm, having a forward and a backward movement, and devices for impelling the arm a fixed distance to complete the throw of the phase-completing device; locking devices are actuated by the arm in its forward movement, whereby the phase completing device is locked and retained in position while the arm is withdrawn to complete its backward movement and releasing devices are actuated by the next forward movement of the arm an equal distance to thereby throw out the locking devices and release the phase-completing device.

552,574. Electric Switch. Sigmund Bergmann, New York, N. Y. Application filed April 23, 1895.

Two or more pairs of line wire contacts are provided, whose acting faces lie in different planes, and a revoluble contact device having two or more ratchets arranged in different general planes, each ratchet having alternate conductive and non-conductive contact faces, to which the corresponding pairs of line wire contacts are adapted

552,594. Electric Gas Lighting Burner. Joseph E. Swendeman, Boston, Mass. Application filed June 7, 1895.

There is a fixed electrode, also a movable electrode provided with a longitudinal slot and swinging on a fulcrum pin passing through the slot, the movable electrode being provided with a suitable terminal, and having a notch in its lower portion, an oscillating disk or member having a pin or projection adapted to engage the notch in the movable electrode, and raise and swing the latter on its fulcrum to cause its terminal to make and break contact with the fixed electrode, and a spring for retracting the movable electrode after its release.

552,604. Electric Railway System. Henry Brandenburg, Chicago, Ill. Application filed October 5, 1894.

The invention claimed is described as the combination with the conduit having a slot, of a feed conductor mounted in a fixed position in the conduit, a transversely movable slot closer, a trolley wire carried by said slot closer at a point removed from the slot, and contacts for establishing electrical connection between the trolley wire and feed wire when the slot closer is moved to open the slot.

552,631. Trolley. Bert Dale, Milwaukee, Wis. Application filed May 9, 1895.

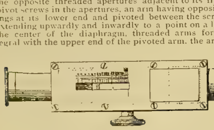
The arrangement includes a forked trolley arm, having conical apertures, a hollow trolley wheel, a sleeve extending entirely through the wheel, conical bearings located in the sleeve and engaging the conical apertures, and provided in their sides with longitudinal slots or recesses, and at their inner ends with tubular extensions, a spring located in the sleeve, and having its ends seated in the tubular extensions of the conical bearings, and set screws passed through the wheel and sleeve, and engaging the slots or recesses in the sides of the conical bearings.

552,680. Electric Cut-out and Insulator. Herbert A. Wagner and Ferdinand Schwedtmann, St. Louis, Mo. Application filed January 21, 1895.

There are an inclosing box or case of metal for a transformer, two metallic shells carried thereby, a line wire supporting insulator mounted on one end of each shell, a removable core of non-conducting material within each shell and protruding from the other end of the shell, and a fusible cut out carried by each core and interposed in the circuit between each line wire and the coils of the transformer.

552,689. Telephone Transmitter. Isidor J. Kusel, St. Louis, Mo. Application filed April 29, 1895.

The cut shows a transmitting diaphragm arranged in a vertical plane, a horizontal stationary U-shaped bracket fixed by a screw at a point immediately beneath the edge of and extending at right angles to the diaphragm, and having the opposite threaded apertures adjacent to its free ends, pivot screws in the apertures, an arm having opposite bearings at its lower end and pivoted between the screws and extending upwardly and inwardly to a point on a line with the center of the diaphragm, threaded arms formed integral with the upper end of the pivoted arm, the arm being



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horizontal, and the arm extending obliquely upward, a carbon button mounted upon one arm, and a weight mounted for adjustment upon the other arm, the arms, button and weight being located interior of a vertical line drawn through the pivot point of the pivoted arm.

552,724. Multiple Switchboard System for Telephone Exchanges. Charles E. Scribner, Chicago, Ill. Application filed March 17, 1892.

An electrical annunciator is provided with two independently pivoted armatures, one armature carrying a hook or detent adapted to engage with and retain the other armature which serves as a drop or target, the armature carrying the hook being adapted to be operated by a less current than is required to operate and retain in position the armature which serves as a target.

552,725. Spring-jack for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed July 30, 1892.

The combination is claimed with a supporting plate of insulating material having perforations and the grooves formed therein, of the thimbles in perforations, the contact springs carrying contact points, and the contact straps therefor mounted in the grooves, and the screws passing through the springs and straps into the plate to secure them to the same.

552,726. Switchboard System for Telephone Exchanges. Charles E. Scribner, Chicago, Ill. Application filed April 26, 1893.

The indicator is adapted to display a signal when released. There are two electro-magnets, armatures therefor, and catches controlled by the different armatures, one catch being normally engaging with the indicator and the other normally disengaged therefrom, but adapted to be brought into engagement when its magnet is energized.

552,727. Annunciator for Telephone Switchboards. Charles E. Scribner, Chicago, Ill. Application filed May 2, 1893.

[illegible] helices are connected in series in an electric circuit, [illegible] of high impedance, an armature common to both [illegible] the helices being arranged to operate [illegible] oppositely upon the armature and there is [illegible] shunt of the helix of high [illegible]

552,72[illegible]. Multiple Switchboards. Charles E. Scribner, Chicago, Ill. Application filed June 1, 1889.

[illegible] telephone line provided [illegible] the telephone line con[illegible] connection of each of the [illegible] the line [illegible] plug, and a switch provided [illegible] adapted to be operated by [illegible] removing the plug there[illegible] the plug from its socket [illegible] connected with the ground.

[illegible] Switch. Charles E. Scribner, Chicago, Ill. Application filed May 9, 1893.

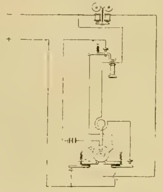
[illegible] contact piece arranged in [illegible] being in [illegible] The plug is adapted to [illegible] contact piece.

552,730. Telephone Circuit. Charles E. Scribner, Chicago, Ill. Application filed June 16, 1893.

A microphone is included in a local battery circuit, two induction coils having their primary helices connected in circuit with the microphone, and their secondary helices in series in a telephone line, and a telephone receiver in shunt or parallel circuit with one of the secondary helices.

552,733. Automatic Electric Alarm. Thomas J. Stansel, Laredo, Tex. Application filed June 1, 1895.

The claim is given: A switchboard consisting of a suitable base, a series of metallic strips embedded in the base, a second series of metallic strips arranged at right angles thereto, crank levers pivoted to the under strips at points between the intersecting upper strips, said crank lever making contact with the top strips, a bar on the upper edge of the switchboard connected with the battery, suitable connections between a bell and the bar, connections between the bell and the upper metallic strips, in combination with a clock having a series of wires protruding on the face, and connecting with the lower metallic strips, the minute-hand making electric connections when in contact with the wires on the face, a second series of wires protruding in a manner to make contact with the hour-hand and connected with the battery.



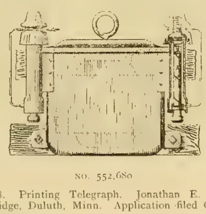
NO. 552,516.

552,734. Telephone Switchboard and Circuit. Thomas C. Wales, Jr., Boston, Mass., and Theodore Spencer, Philadelphia, Pa. Application filed July 25, 1895.

This includes a signaling circuit and a conversation circuit, a switching relay having two coils of different resistance, and a circuit closing armature, the coil of least resistance being in a grounded end of the signaling circuit with a resetting annunciator and battery, the high resistance coil being in a circuit, having one end open in a switch in the conversation circuit, the other end being grounded through the battery, and means for closing the circuit, including the high resistance coil and battery, consisting of a cord plug having a third conductor to ground through a resistance.

552,735. Trunk Line for Telephone Exchanges. Thomas C. Wales, Jr., Boston, Mass. Application filed August 24, 1895.

This is for the combination of a signaling circuit extending between two stations and provided at one with a normally open and at the other with a normally closed automatic circuit controlling switch; a low resistance signal at the open switch station, and a high resistance signal, and a source of current at the other or closed switch station, included serially in one of the conductors of the circuit; a relay also located at the latter station and having independent low and high resistance windings, the former being connected in the signal circuit conductor; a resistance at the latter station uniting the two conductors of the signaling circuit alternatively and parallel to their connection through the normally closed switch; an independent derived circuit including the high resistance winding of the relay and the source of current, extending from a point of the signaling circuit conductor between the low resistance relay winding and the source of current to the second switch and normally open therein, but adapted to be closed when the switch is operated to open the signaling circuit, and a normally open shunt round the high resistance signal controlled by the said relay, whereby upon the operation of both terminal switches the independent derived circuit containing the high resistance relay winding and source of current is closed, and immediately operates to withdraw the high resistance signal by closing a shunt circuit around it.



NO. 552,680.

552,738. Printing Telegraph. Jonathan E. Woodbridge, Duluth, Minn. Application filed October 7, 1895.

In the transmitter there is the combination of the commutator, the series of pole changers, the key levers, one of the pole changers being connected directly with a key lever and actuating mechanism for shifting the other pole changers, each key lever, except that connected directly with a pole changer, being arranged to control a different combination of pole changers.

552,755. Conduit System for Electric Railways. Charles A. Gaines, New York, N. Y. Application filed May 1, 1894.

A longitudinally movable rod, a cam shoe carried by the car for operating the rod, movable parts at opposite ends of the rod for receiving the thrusts of the shoe and communicating them to the rod, the one part acting oppositely to the other, and the rod divided into two sections, with an interposed spring expansion joint adapted to yield in case the rod is simultaneously acted upon by the shoes of two successive cars.

552,756. Electric Circuit Controller. Hermann A. Gorn, New York, N. Y. Application filed July 26, 1895.

A hand actuated switch, a circuit changer and contact plates and rheostat and two electro-magnets for moving the circuit changer in opposite directions are the parts described, the circuits being arranged so that the circuit changer breaks the circuit to its actuating magnet at the end of its movement and closes the circuit to the magnet acting in the other direction, ready for the current to be turned on by the switch.

552,776. Electric Signaling. Frank G. Pratt, Revere, Mass. Application filed August 20, 1894.

The features claimed are a signaling circuit, a series of two or more make-and-break mechanisms included in the signal circuit and arranged to operate in a certain predetermined order to effect a restoration of the signal circuit and a series of track instruments for operating the make-and-break mechanisms in a predetermined order.

552,803. Automatic Electric Alarm. George B. Williams, Texarkana, Tex. Application filed April 8, 1895.

This device comprises casing, a diaphragm therein, means for applying a fluid pressure to one side and a regulated yielding pressure to the other side of the diaphragm, a stem for the diaphragm having an enlargement, a contact piece forming one terminal of an electric circuit, and a pivoted contact finger connected to the enlargement and forming the other terminal of the circuit, the pivoted finger being adapted to be moved into and out of contact with the contact piece.

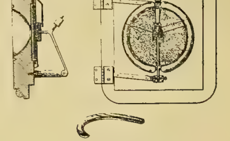
552,816. Telephone. Norval L. Burchell, Washington, D. C. Application filed October 29, 1895.

The movement of the telephonic apparatus to the position of non-use for opening the circuit extinguishes the lamp used in connection with the telephone.

552,823. Telephone System. Frank R. Colvin, New York, N. Y. Application filed February 2, 1895.

The claim includes a number of telephone lines extending to the central station, a cord connector for connecting the circuits together for conversation, an induction coil having the secondary connected in series with the cord connector, and a telephone transmitter and receiver in circuit with the primary of the induction coil, whereby the telephone set may remain continuously in operative connection with the cord connector.

552,858. Electric Motor. George L. Thomas, New York, N. Y. Application filed March 19, 1895.



NO. 552,689.

Claim 1 reads as follows: The combination with a motor operated by gas pressure of a closed reservoir containing a volatile fluid, a conductor in said fluid, a source of electricity in constantly closed circuit with said conductor, whereby the conductor is heated and gas under pressure is continuously produced, a condensing chamber and a valve between the condensing chamber and the reservoir, the said valve being constructed to open at a determinate gas pressure and so to permit a flow of gas from the reservoir directly to the chamber.

552,865. Telephony. Frank R. Colvin, New York, N. Y. Application filed January 14, 1895.

This arrangement includes two limbs or lines extending between two telephone sets, two branches or bridges, each containing a battery and a microphone or battery transmitter, and two parallel branches each containing a receiver whereby the battery current through each transmitter finds path over the two receiver branches in parallel to thus decrease the resistance of the battery circuit through the microphone, while incoming currents traverse the receiver instead of the branch containing the transmitter.

552,866. Telephone Switch. George W. Coy, Milford, Conn. Application filed April 1, 1895.

A transmitting apparatus movably mounted for the operation of switch mechanism, a signal operated by replacing the receiver to warn the user to move the transmitting apparatus into switching position, and a switch operated by the transmiting apparatus to stop the signal.

552,867. Desk Telephone Apparatus. George W. Coy, Milford, Conn. Application filed April 1, 1895.

The first claim is for the combination with switch mechanism thereof, of transmitting apparatus of which the transmitter is in a fixed position, and a speaking tube leading thereto and provided with an air stop or valve and adapted to operate the switch mechanism.

552,874. Electric Arc Lamp. William S. Bartholomew, Chicago, Ill. Application filed September 23, 1895.

The claim: In an electric lamp having its arc localized, the combination with a pair of frame posts, a cross plate from which such posts depend and an apertured cross plate uniting such posts immediately above the arc, of a pair of guide rods extending between such upper and lower cross plates, a pair of guide rods secured to the frame immediately below the arc and extending downwardly, a traveler mounted to slide upon each pair of guide rods, the upper traveler being counterweighted, flexible connection between the two travelers, sheaves at the upper portion of the lamp frame over which such flexible connection is hung, a carbon holder or clamp for co-operating with each traveler, ball and socket joint connection between the travelers and their co-operating holders, apertured guide plates immediately above and below the arc adapted to prevent the angular movement of the carbon pencils.

Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, JANUARY 25, 1896. No. 4

## Transformer Equipment for Street Railway Service at Niagara Falls.

By Orrin E. Dunlap.

In supplying power to operate the Buffalo & Niagara Falls electric railway and the lines of the Niagara Falls & Suspension Bridge Street railway, the Niagara Falls Power company passes the current from the mammoth generators of its station through a rotary and two static transformers. The principle followed in the conduction of the 500 horse power rotary transformer is that if the armature of a direct current dynamo be tapped at points which are electrically 180 degrees apart, an alternating current can be drawn from the armature, and if this dynamo be run as a motor from the direct current end, an alternating current can be drawn from collector rings tapped on at the points mentioned; and vice versa, if the dynamo be run as a synchronous alternating current motor, a direct current can be taken from the commutator.

The big 5,000 horse power dynamos in the station of the Niagara Falls Power company supply current at 2,000 volts which changes direction 3,000 times every minute. The service performed by the rotary transformer and its accompanying static transformers is to change the alternating current of 2,000 volts into a direct 575 volt current in order that it may be adapted to use on a street railway circuit equipped with the standard electric railway apparatus. Four cables carry the current from the main bus-bars at a potential of about 2,250 volts. Ample room for the extension of the system is afforded. As the system is the quarter-phase, four cables are necessary, two being used for each phase. The cables are connected to the middle points of two double-pole double-throw switches, and when these switches are thrown up the current is thrown into the auxiliary static transformer, the secondaries of which are connected to a quarter-phase starting motor. The armature of this motor is on the same shaft as the rotary transformer armature. When it is desired to start, both switches are first thrown up, then the current is thrown into the starting motor, and the entire shaft starts and is brought up to speed. Then the field circuit of the main armature is closed and the voltage is allowed to build up. Synchronizing lamps determine the phase relation of the armature. These lamps are two in number and they are placed in series with the secondaries of two 2,000 to 100 volt converters, the primaries of which are attached, one to the main dynamo circuit and one to the 2,000 volt side of the static transformer feeding the rotary. As the armature nears synchronism these lights slowly grow bright and then dim, and it is by keeping careful watch of the lights that the operator can determine the proper moment for throwing down the switches. When this is done the dynamo current passing through the two static transformers is reduced in voltage from 2,250 to about 440, while the current is increased in the same ratio. It is at this reduced voltage that the current passes into the alternating current end of the revolving armature, running it as a synchronous motor. In passing through this revolving armature the voltage is increased in the ratio of seven to 10, which makes the final direct current voltage in the neighborhood of 600. At this point the direct current circuit breaker and switch may be closed. The rotary and static transformers were installed by the Westinghouse Electric & Manufacturing company.

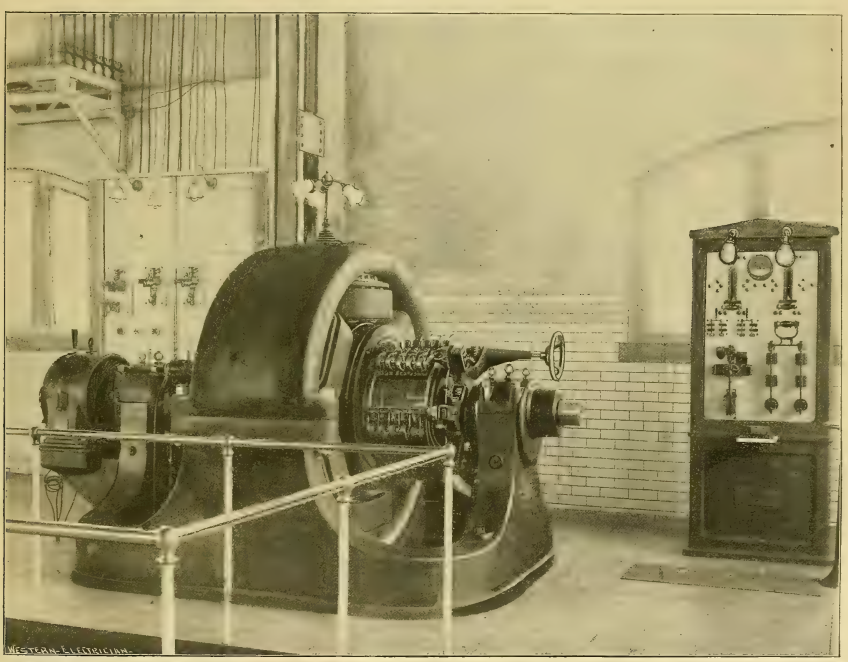


FIG. 1. TRANSFORMER EQUIPMENT FOR STREET RAILWAY SERVICE AT NIAGARA FALLS.

## Assignment of the Standard Electric Company.

On Thursday, the 16th instant, the Standard Electric company of Chicago made an assignment to George N. Stone, a lawyer, in the County Court of Cook county. The company has done a large business, particularly in manufacturing dynamos and arc lamps. The announcement of the assignment came as a surprise to most people in the business. The company's offices are in the Home Insurance building, and its factory in Canal street, Chicago. It has borne a first-class reputation among manufacturers and users of electric light machinery, and made both arc and incandescent apparatus, although its principal business has been in arc machinery. No statement of the company's condition has yet been issued but the liabilities are supposed to be about $75,000. Manager D. F. Perry states it as his belief that the assets will prove to be nearly three times that amount, and is emphatic in his assurance that all creditors will be

paid in full. He expects the company to reorganize and resume business. There has been a good demand for the company's apparatus, but collections have been slow and this is given as the principal cause of the failure. Manager Perry has the confidence of the trade and will doubtless be able to get the company in shape again with little delay.

## Delegates and Visitors.

Following is a list of the delegates and visitors in attendance at the convention of the Northwestern Electrical association at Milwaukee, last week:

Abbott, A. V.....Chicago.
Andrae, Herman.....Milwaukee, Wis.
Angel, J.....Hammond, Ind.
Arnold, B. J.....Chicago.
Atkinson, J. M.....Chicago.
Baker, C. O.....Chicago.
Baker, A. O.....Sheboygan, Wis.
Bashford, R. M.....Madison, Wis.
Beggs, John I.....Cincinnati.
Boggis, H. F.....Milwaukee, Wis.
Boyer, F. N.....Chicago.
Brooks, H. H.....Chicago.
Brown, R. E.....Mankato, Wis.
Buckley, W. J.....Chicago.
Bunce, A. C.....Chicago.
Burch, L. W.....Madison, Wis.
Chandler, A. D.....Chicago.
Chat, J. B.....Chicago.
Church, J. V. S.....Chicago.
Clark, E. L.....Chicago.
Clark, Jr., James H.....Chicago.
Cole, G. L.....Beloit, Wis.
Coleman, S. G.....Milwaukee, Wis.
Collins, Carroll.....Green Bay, Wis.
Collins, L. W.....Chicago.
Conway, G. M.....Milwaukee, Wis.
Cook, Wallace P.....Oconto, Wis.
Copeland, F. A.....La Crosse, Wis.
Cuno, Charles.....Oconomowoc, Wis.
Cutler, H. H.....Chicago.
Debell, C. L.....Sheboygan, Wis.
DeLand, Fred.....Chicago.
Dickey, Edmund.....Noblesville, Ind.
Donohue, F. E.....Chicago.
Farwell, G. A.....Waukesha, Wis.
Fisher, W. W.....Milwaukee, Wis.
Fleming, T. J.....Milwaukee, Wis.
Gille, H. J.....St. Paul, Minn.
Gordon, Thomas S.....Chicago.
Grimm, George.....Jefferson, Wis.
Grover, T. F.....Wauwautosa, Wis.
Harding, J. H.....La Porte, Ind.
Hartley, B.....Chicago.
Hawley, G. W.....Marinette, Wis.
Higgins, H. C.....Marinette, Wis.
Hixson, H. R.....Chicago.
Howell, W. S.....Harrison, N. J.
Hussey, M. H.....Waukegan, Wis.
Jones, J. H.....Milwaukee, Wis.
Korst, P. H.....Racine, Wis.
Lasell, Edward.....Chicago.
Latimer, H. M.....Chicago.
Lord, I. P.....Waupaca, Wis.
Luthy, G. G.....Peoria, Ill.
McLaren, G. S.....Milwaukee, Wis.
McLeod, J. D.....Milwaukee, Wis.
McRoy, J. T.....Chicago.
Mercein, T. R.....Milwaukee, Wis.
Morawetz, F.....Milwaukee, Wis.
Mullen, E. G.....Milwaukee, Wis.
Murphy, J. C.....Chicago.
Newton, George M.....Sparta, Wis.
Norcross, Pliny.....Janesville, Wis.
Page, C. G.....Oshkosh, Wis.
Pamperin, F. A.....Oconto, Wis.
Perry, F. L.....Chicago.
Pigeon, Frank A.....Milwaukee, Wis.
Rau, O. M.....Milwaukee, Wis.
Remington, W. A.....Chicago.
Richer, Carl.....Milwaukee, Wis.
Robertson, S.....Racine, Wis.
Rogers, L. H.....Cleveland.
Ruggles, C. H.....Milwaukee, Wis.
Schuette, John.....Manitowoc, Wis.
Smith, W. C.....Milwaukee, Wis.
Smith.....Milwaukee, Wis.
Stephen, J. L.....Chicago.
Sturges, G. W.....Joliet, Ill.
Terry, A. S.....Chicago.
Terry, J.....Chicago.
Thorpe, W. H.....Chicago.
Weimer, I.....Milwaukee, Wis.
Wheaton, M. C.....Chicago.
Wiley, J. F.....Stevens Point, Wis.
Williamson, J. B.....Chicago.
Williamson, J. B.....Chicago.
Williams, O. B.....Whitewater, Wis.
Wilson, John McNeill.....Chicago.
Wilson, C. P.....Chicago.
Wilson, William.....Chicago.
Wyman, F. D.....Milwaukee, Wis.

The electrical equipment of the temporary postoffice building on the Lake Front Chicago, will include two electric elevators.

## Chicago Delegation.

The scene at the depot of the Northwestern Railroad, Chicago, was a lively one when the Chicago delegates gathered to take the train which would carry them to Milwaukee to attend the fourth annual convention of the Northwestern Electrical association. It was quite a merry party, and the trip to Milwaukee was thoroughly enjoyed. Chicago was well represented at the convention, as will be seen from the following list of delegates:

M. B. Austin, Safety Insulated Wire company; George S. Searing, Hart & Hegeman; F. S. Terry, Sunbeam Incandescent Lamp company; W. W. Low, president Electric Appliance company; James Wolff, New York Insulated Wire company; C. C. Baker, Chicago General Fixture company; J. H. Reid, Westinghouse Glass Factory; W. P. Sullivan, the *Electrical Engineer;* Fred DeLand, *Electrical Engineering;* C. W. Woodward, Electric Storage Battery company; Thomas G. Grier, Grier Brothers; J. M. Hill, Columbia Incandescent Lamp company; W. J. Buckley, Fort Wayne Electric corporation; F. S. Vielé, Standard Underground Cable company; H. Roy Osborn and William Gallagher, Osborn Electric company; W. D. Pickels, Warren Webster company; F. L. Perry, WESTERN ELECTRICIAN; George Cutter, L. L. Summers. Accompanying the Chicago delegation were Luke Lilly, De Vere Electric company, Cincinnati, Ohio, and J. H. Harding, La Porte Electrical Works, La Porte, Ind.

## Arnold Electric Power Station System.

The paper on this subject read by E. R. Cunningham before the convention of the Northwestern Electrical association at Milwaukee on January 16th includes a detailed description of the equipment of the station of the Fort Dodge, Ia., Light & Power company, of which he is superintendent Readers of the WESTERN ELECTRICIAN are already familiar with this plant and the general principles upon which the system is built, as the first description of the plans of Mr. Arnold appeared in these columns on May 19, 1894 This was followed on October 12, 1895, by a special article on the Fort Dodge station, which was profusely illustrated and described in detail. Mr Cunningham in his paper gave some additional information, principally relating to special applications of the system and showing how it could be adapted to many special conditions, as will be seen by the following abstract

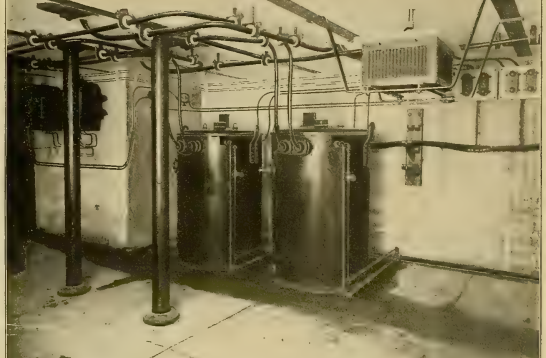


FIG 2 TRANSFORMER EQUIPMENT FOR STREET RAILWAY SERVICE AT NIAGARA FALLS.

Another important feature of the system is the fact that any standard make of dynamos and engines can be utilized, thus necessitating no radical departure from the present lines of manufacture For this reason many of the present plants can be rebuilt to conform to this system, utilizing a large part of their old equipment Thus, at Fort Dodge, we had two high speed engines and four Thomson Houston arc light machines The engines were not very efficient, being of the common slide valve type. They would not bring much on the market and we did not wish to throw them away, so we installed an auxiliary shaft, ordinarily driven from the sheave shown in Fig 3. At either end of this auxiliary shaft we installed one of these old high-speed engines, to be used only in case of emergency Upon this auxiliary shaft are placed friction clutch pulleys, which are belted to the old Thomson Houston arc machines It will thus be seen that power from any one or all of the four engines is available for any one or all of the seven machines which we have thus far installed. This makes the question of a breakdown practically impossible.

This system is subject to various applications, Fig. 2 representing its adaptation to an electric lighting plant operating alternating and arc lights. It will be noticed that this plant has four alternating generators and four arc light generators, all running at the same speed. Each armature is carried on a quill in independent bearings of its own, and arranged to be connected to the shaft by means of magnetic or positive jaw clutches, as desired. The shaft is separated in the middle, so that either portion can be shut down, while the other is in operation, and on each end is placed a steam engine of some improved form. With such an arrangement it is possible to start and stop any generator in the plant without stopping either engine. The dynamos being brought up to speed as motors, the clutches which connect them to the driving shaft are then thrown in, and by means of suitable switches the machines are converted into generators, and then can be cut in on the line for active service. The system comprises numerous electrical devices for controlling the speed of these machines and otherwise making the plant easy to handle

Fig. 3 shows the design used for isolated plants in office buildings and apartment houses. In this case one of the engines can be a steam engine which can be used for operating the lights of the building through the winter months, the exhaust steam being used for heating the building, while in the summer months the lights are driven from a gas engine located on the other end of the shaft, and the steam plant allowed to stand idle. The result is a great reduction in the cost of labor during the summer months, and at the same time it is possible to have practically a duplicate plant with but a single investment, as either generator can be operated from either engine.

The Fort Dodge plant started July 1, 1895, very successfully, and has been in operation ever since without any expense for repairs, so far as it relates to this system The bearings all being arranged so that a box can be removed and a new one substituted within a very short time, and there being but three sizes of bearings, by carrying one extra piece for each bearing, we are insured against shut-downs caused by the bearings. The consumers, being assured of constant uninterrupted service, have been willing to pay a first-class price to have their buildings properly wired. They have also been willing to pay for the very best material, and to have the work done according to insurance rules and the best modern practice As an illustration of how carefully this has been done, every drop cord has been soldered and taped in every socket and rosette The value of this cannot be overestimated, the result being that a short-circuit is a thing unknown, and the company is not obliged to go to the expense of keeping a trouble man, and the consumer is never out of light

At a recent meeting of the stockholders of the New Orleans City & Lake railroad the following named directors were elected A Baldwin, John D Taggart, R E Craig, C M Soria, R M Walmsley, C H Hyams, Frank T Howard, John W Castles, Cartwright Eustis, J B Levert, J C Denis, James H Maury At a subsequent meeting of the board, the following named officers for the ensuing year were elected Albert Baldwin, president, James H Maury, president *pro tem*, A H Ford, secretary.

# THE CONVENTION

## Of the Northwestern Electrical Association at Milwaukee, January 15 17, 1896.

The meeting of the Northwestern Electrical association at Milwaukee, which was opened on January 15th, was an interesting gathering of central station men, experts and the usual number of supply men. All gave close attention to the meetings, and the discussion of papers read before the meeting was participated in by a large number of the delegates. Considerable business was transacted, including the election of officers for the ensuing year.

In opening the proceedings President Grimm read his annual address, which is herewith appended:

THE PRESIDENT'S ADDRESS.

Instead of delivering the customary address, dealing with subjects of interest in the electrical field, I take the liberty to present for your consideration some thoughts relating to the welfare of our association. This association is composed of an extraordinary class of men, extraordinary even in an age when every phase of commercial and intellectual life produces men of pre-eminent ability and energy. It is indisputable that those representing the electrical business and progress bear upon this problem, I believe a plan could be devised that would place us upon a basis consistent with the dignity of the membership. The necessity is urgent, and I commend the subject to your prompt consideration. Let me call your attention to another matter. You should at once distinctly define the extent to which this association will go, and to which its officers and committees are authorized to act, in furthering proper legislation relating to the electrical interests, and incurring expense therefor. During the short period that I have held this office, I have been solicited by various parties from several states to give information and lend assistance in overcoming attempted adverse legislation, furthering proper legislation, and similar matters. It has been my invariable rule to reply that the scope of my powers did not permit me to take an active hand in the matter, and that the object of our association was not to interfere in legislation except so far as the knowledge gained by the members and their influence as individuals would aid in that direction. Whether I was right or wrong in this construction, it is desirable that you define clearly the position of the association for the guidance of your future officers. Personally I do not believe it practicable for us to take hand in shaping legislation, except as in the manner indicated; our lack of funds for defraying expenses, and the extent of the territory our association covers, seem conclusively to forbid this. But we could, with little or no expense, do most material good to the electrical interests and aid in bringing about laws, just in themselves, and adapted to the wants of the times. We could draft and propose laws that would take the place of the feverish abortions of justice presented at almost every session of the legislatures, which would receive the support of all right-minded citizens, and we could, as in this state, completely answer all adverse arguments by ourselves proposing to meet the public demands by just laws and in an honorable manner. By drafting a uniform system in that line, to be submitted to the legislatures of the different states, by the individual members of the association, however, and not by the association as a body, we would disarm opposition and accomplish untold good for the electrical interests without incurring any expense. There are other matters calling for attention on your part. The rules of wiring, etc., adopted by various boards of underwriters, are frequently oppressive and impracticable in many details. The safest body of men to draft these rules are practical electricians, and a thorough system embodying the best experience of both underwriters and electricians would be safer and less oppressive than any we now have. I think these remarks will suffice for this time. We do not want to undertake too much at once; but whatever you may determine in regard to the work we should accomplish, do not let this convention adjourn without having devised some means of putting us upon a good financial basis.

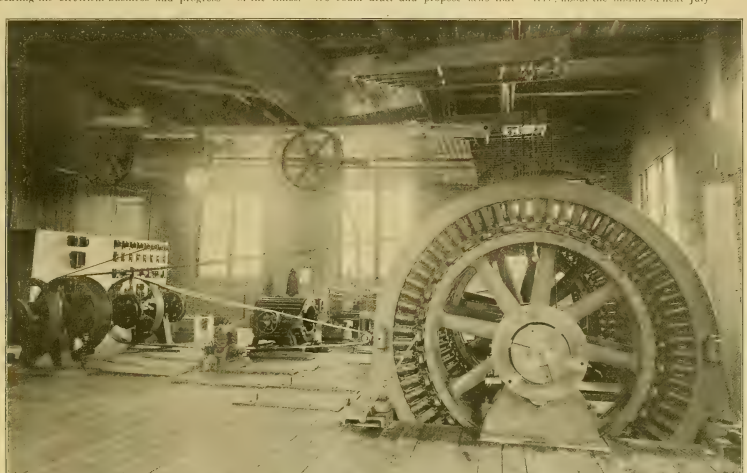


FIG. 1. ARNOLD ELECTRIC POWER STATION SYSTEM.—INTERIOR VIEW OF FORT DODGE PLANT.

of the age, stand in the front rank of intellectual ability, courage and business daring. But I will stop right here lest a feeling of pride and self-satisfaction take possession of you, which would militate against the object of my remarks. The fact is I have a grievance to which I desire to lend words, which, however, to be generous to you, I do not desire to have printed in the official records of our association. This grievance is the more emphasized by reason of the fact that since my membership I have received many benefits in the nature of knowledge and experience, and have seen the grand possibility of far greater accomplishments than we have yet obtained. Since my assuming the duties devolving upon me as your president, and owing to the fact of the absence of our secretary for a considerable period of time, I have become exceedingly familiar with the "business end" of this association, and I marvel at a body of men handling, controling and commanding an enterprise requiring such consummate skill and ability, and such masterful tact in dealing with the prejudices of public opinion, should base the fabric of its association upon a foundation so utterly unstable and insufficient. Think of it. Without having incurred any extraordinary expense, each succeeding report of our secretary shows a deficit in the treasury which no juggling with figures is able to conceal, and it is only by the strongest efforts of the secretary and president combined, that it is possible to raise sufficient funds from generous-hearted advertisers to pay the expense of publishing the proceedings of our conventions. It is apparant that a radical change must be inaugurated; either the annual dues must be increased, and prompt payment insisted upon, or other provisions must be made. If for a few minutes you would bring that skill that has made your individual business a success to

On Wednesday the greater part of the forenoon session was devoted to the transaction of general business. In the afternoon William J. Buckley, author of "Electric Lighting Plants; Their Cost and Operation," read a paper entitled "Modern Apparatus vs. Existing Conditions."

The morning of the second day, Thursday, was set apart for the reading and discussion of a paper on "Economic Expression for Fuel Values." by Arthur Vaughan Abbott, C. E., and a blackboard talk on "Central Station Economies," by Leland L. Summers. Mr. Abbott was unable to be present, so Mr. Summers gave the combined talk on these two subjects. This was followed by the reading by Fred De Land of a paper on the "Upbuilding of the Small Town." In the afternoon the following papers were read: "Storage Batteries in Central Stations," by Maurice Barnett; "Some Facts about Acetylene Gas," by John C. McMynn, M. E., and "The Arnold Electric Power Station System," by E. R. Cunningham.

On Friday, the third day, papers were read on "Economical Results in Modern Isolated Arc Lighting," by F. E. Drake, and "Water Purification for Steam," by John McN Wilson.

During the convention the following named officers were elected for the ensuing year: President, W. B. Baker, Waupaca, Wis.; first vice-president, Charles D. Wyman, Milwaukee; second vice-president, H. C. Higgins, Marinette, Wis.; secretary, Thomas R. Mercein, Milwaukee; treasurer, John Schuette, Manitowoc.

It was decided to hold the next semi-annual meeting of the Northwestern Electrical association in Marinette, Wis., about the middle of next July.

The convention was devoid of especial happenings. The noticeable feature of the gathering was that almost the entire time was devoted to convention business, although Milwaukee displayed its usual hospitality in taking care of the delegates after business hours.

As far as the exhibits were concerned, it was a matter of regret that supply houses and manufacturers did not seize this excellent opportunity to make special displays. It will be remembered that last year's conventions were remarkable for the number of handsome exhibits that were a credit alike to the association and to the supplymen and manufacturers. It is an unquestioned fact, the truth of which is now generally realized by frequenters of electrical conventions, that exhibits are a most attractive feature. The central station man who travels a long way to visit a convention is always glad to see the latest improvements; he is on the lookout for the "new thing" just out, and let it be rumored that a convention is to be marked by numerous and varied exhibits, the out-of-town delegates display all the greater eagerness to be present. In spite of the fact, however, that the exhibits were comparatively few, there was no lack of energetic "representation."

On Thursday evening the association banquet was given in the hall of the Pfister Hotel. Without going into detail it may be said that the committee, consisting of H. Andrae, O. M. Rau and W. C. Smith, discharged its duties admirably. The banquet lasted until midnight,

and many were the witty toasts and brilliant replies; in fact, it was stated in the rotunda after the affair that few if any conventions in Milwaukee have seen a more brilliant entertainment.

## Convention Notes.

The Badger Manufacturing company had an exhibit in one of the parlors. F. Werner represented the company.

M. B. Austin, of the Safety Insulated Wire & Cable company, was, as usual, on hand, energetically pushing the interests of his company.

As was the case last year at the convention held at the Pfister, the exhibitors chose parlors the majority of which opened upon the balcony overlooking the rotunda.

Was James Wolff there? It was rumored that such a gentleman was in evidence, and that he had more or less to say about a wire manufactured by the New York Insulated Wire company.

The Sunbeam Incandescent Lamp company, as usual, was represented by F. S. Terry and A. S. Terry, who were indefatigable in adding to the many friends of the well-known "Sunbeam."

C. W. Woodward, western manager of the Electric Storage Battery company of Philadelphia, attended this as his first western convention, and his visit paid him well, as he made friends on every hand.

The Chicago General Fixture company was represented by C. O. Baker. Mr. Baker made no exhibit, but, like a year ago, he left an impression that will undoubtedly revert to the interest of his company.

George S. Searing came up with the boys and managed to do considerable business in Milwaukee as well as among the convention delegates. Everyone knows Searing and Hart switches, and many took this occasion to place their orders.

An electrical convention would not be complete without the well-known electric specialist, George Cutter; he was at this one, but it was regretted that he made no effort to bring to the front this time any of the numerous unique electrical novelties for which he is so constantly working.

President W. W. Low and William Wilson, of the Electrical Appliance company, were in attendance, but made no exhibit. Mr. Low, as usual, was surrounded by a crowd of old central station friends, who now so rarely have a chance to grasp his hand, as his close application to business in Chicago keeps him almost entirely off the road.

Of course the General Electric company was well represented. F. N. Boyer, M. C. Wheaton, A. C. Bunce, W. S. Howells and R. A. Swain did the honors in a large parlor opening onto the balcony, and although the company made no attempt at display beyond a few pieces of apparatus, General Electric literature was everywhere to be found.

Ernest Lyle Clark was seen at the convention, but without his partner, J. Valentine. As the Valentine-Clark combination has a way of traveling in pairs, it was wondered if this was a case of stealing a march. However this may have been, Clark found many welcome representatives of the R. Thomas & Sons company, porcelain manufacturers.

Nothing short of sickness could have kept Chicago Manager Joseph M. Hill, of the Columbia Incandescent Lamp company from, a Northwestern convention. Mr. Hill is general sales agent for the Wagner Electric Manufacturing company as well, and in this dual capacity he "did" the convention. Mr. Hill has the enviable reputation of the man who sells strictly first-class goods and thinks therefore he is entitled to fair prices.

In a large, handsome parlor was found at all hours of the day, and night as well, that energetic contingent that so well represents the interests of the Fort Wayne Electric corporation. W. J. Buckley, J. C. Murphy and C. E. Wilson did the honors, backed up by numerous delicacies in the way of luncheon and other refreshments, and it is safe to say there were few at the convention who did not spend considerable time with this jolly party.

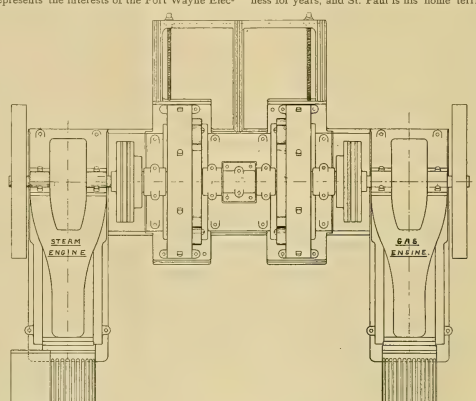



FIG. 3. ARNOLD ELECTRIC POWER STATION SYSTEM—SPECIAL ARRANGEMENT FOR ISOLATED PLANTS IN OFFICE BUILDINGS

L. W. Collins, with his energetic efforts and persuasive manners, made an excellent impression in favor of Collins' well known compound, Boudreaux brushes, and the numerous other specialties that have helped to win for Lee & Collins their enviable reputation for unique and excellent specialties. Lee & Collins have of late been doing some good work in securing numerous orders for Weston instruments.

"Crefeld" insulated wires and cables were well represented by Edward Lasell, of Edward Lasell & Co., 167 Dearborn street, Chicago, who have recently been appointed general western agents for this excellent line of wires. The 10 years' experience Mr Lasell has acquired in selling wire, coupled with such a high-grade wire will no doubt result in a large consumption of "Crefeld" wire in the West.

General Manager Herbert H. Brooks and A. D. Chandler, of the American Circular Loom company, were decidedly in evidence, and in their usual forceful manner impressed the members of the convention individually with the fact that the American Circular Loom company was in the West with headquarters at Chicago for business, and that their large stock carried in Chicago was the best evidence of the fact that flexible conduit was meeting with remarkable favor.

Manager Lewis H. Rogers, of the Adams-Bagnall Electric company of Cleveland, arrived the second day. Mr. Rogers brought with him several handsome A. B. series arc lamps, and these, together with a distribution of one of the handsomest electrical catalogues that have recently been put on the market, together with Mr. Rogers' energetic work, made a good impression and secured a number of orders for this now successful and growing Cleveland enterprise.

H. J. Gille, agent of the Washburn & Moen Manufacturing company at St. Paul, Minn., was one of the most energetic workers at the Milwaukee convention. Mr. Gille left hardly a spot or a pocket without the Washburn & Moen company's "new hand-book for 1896." The Washburn & Moen company made a good selection in placing Mr. Gille in the western territory, as he has been identified with the electrical supply business for years, and St. Paul is his home territory. He has many friends in that section of the country, as his good work for the Washburn company would indicate.

G. G. Luthy, of the Royal Electric company, Peoria, was one of the first to arrive at Milwaukee, and one of the last to leave. Constant in his attendance, and with an energy deserving of praise, he did excellent work in the interests of the Royal Electric company. Mr. Luthy brought with him the company's new transformer, which is claimed to be the most efficient converter yet produced. Almost every man interested in such apparatus sooner or later found his way to Mr. Luthy's quarters, where the many excellent novel features of the transformer were carefully explained. Mr. Luthy has had considerable experience in the line of business that he has

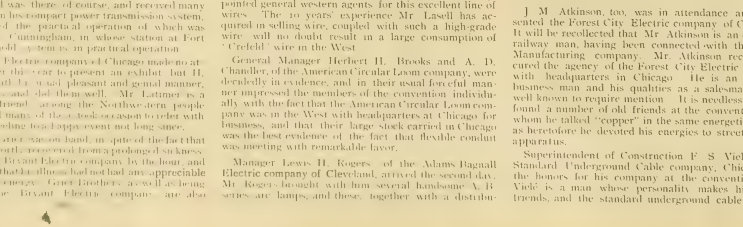


FIG. 2. ARNOLD ELECTRIC POWER STATION SYSTEM—ARRANGEMENT OF FOUR ALTERNATING AND FOUR ARC MACHINES IN LIGHTING PLANT

hand outstretched, and the inquiries for Valentine were as numerous as the hand shakes.

E. J. Arnold was there, of course, and received many compliments on his compact power transmission system, as also upon one of the practical operation of which was read by E. B. Cunningham, in whose station at Fort Dodge the Arnold system is in practical operation.

The Central Electric company of Chicago made no attempt whatever this year to present an exhibit, but H. D. Latimer with his usual pleasant and genial manner, did the honors and did them well. Mr. Latimer is a man of many friends among the Northwestern people especially, and many of them took occasion to refer with much kindly feeling to the happy event not long since.

Thomas G. Greer was on hand, in spite of the fact that he had only just recovered from a prolonged sickness. Tommy called Bryant Electric company's booth, and it was evident that his illness had not had any appreciable effect upon his energy. Greer Brothers, as well as being agent for the Bryant Electric company, are also represented, and it is prophesied that he has a bright future before him.

J. M. Atkinson, too, was in attendance and represented the Forest City Electric company of Cleveland. It will be recollected that Mr. Atkinson is an old street railway man, having been connected with the Walker Manufacturing company. Mr. Atkinson recently secured the agency of the Forest City Electric company with headquarters in Chicago. He is an energetic business man and his qualities as a salesman are too well known to require mention. It is needless to say he found a number of old friends at the convention, with whom he talked "copper" in the same energetic manner as heretofore he devoted his energies to street railway apparatus.

Superintendent of Construction F. S. Viele, of the Standard Underground Cable company, Chicago, did the honors for his company at the convention. Mr. Viele is a man whose personality makes him many friends, and the standard underground cable was kept

well to the front. There were a number of representatives of wire and cable concerns present, and it was a matter of regret that Manager Wiley of the Chicago office of the Standard Underground Cable company could not also be present, but in the selection of a man to represent him he could not have done better than to delegate Mr. Vielé. Mr. Vielé did the honors in truly royal style.

In room 11, Osborn Brothers and the Westinghouse Glass company entertained. The former concern was represented by H. Roy Osborn and William Gallagher. It is needless to say that these gentlemen let the world know that there was a new interior conduit on the market, and it is rumored that this new "Osborn specialty" is meeting with remarkable favor. This conduit has been developed by Osborn Brothers at great expense. Osborn brothers are among Chicago's most energetic and rapidly growing supply dealers, and the production of this valuable specialty marks but one of their many progressive steps. The Westinghouse Glass company was represented by J. H. Reid. It is rumored that Mr. Reid took several handsome orders.

The American Carbon company of Noblesville, Ind., came nobly to the front, represented, in the person of Edwin Dickey. Mr. Dickey was in constant attendance at the Pfister, and without doubt his presence at such a time will revert strongly in the interests of his company. Mr. Dickey, who has for so long been connected with the American Carbon company, is most aggressive in his competition with concerns in his line of business who seek a monopoly. He is a "fighter" in every sense, and with the excellent production of his company behind him, he has brought it to its present prosperous condition. Mr. Dickey said: "The American Carbon company is in a better position to-day financially than it has ever been. Backed by the strongest kind of Indianapolis and other capital, it proposes to fight most energetically, and in every legitimate way, all combinations that would tend toward monopoly. Good goods at fair prices is what the consumer of carbons desires, and we propose to show the people of this country that there is no one in a better position than we to give them just such treatment as this."

A display that attracted a great deal of attention was that of the vitrified terra cotta conduit made by John T. McRoy, 36 South Clark street, Chicago. The material used in construction is shale, which is thoroughly ground and rendered free from all rough particles, a most objectionable feature in some of the conduits heretofore in use. During the process of manufacture the terra cotta is subjected to shrinkage to such a degree that a perfectly dense mass is secured, thereby rendering the conduit, when finished, absolutely nonporous. Not only is the terra cotta vitrified throughout, but all surfaces, interior and exterior, are glazed as an additional precaution against moisture. The interior of the ducts being finished perfectly smooth, with rounded edges, there are no projections to impede the drawing in of the cable. The conduit is manufactured in multiple duct form of any desired number (from one to 12) and cable capacity. The section lengths are about six feet. As the use of cement or concrete is unnecessary, the services of high priced artisans are not required. The conduits can be installed by comparatively unskilled labor at any season of the year. The points of superiority claimed for this invention are that it is imperishable, so far as corrosion is concerned; it is absolutely non-porous, effectually excluding moisture, gases, etc., from the cable; it is perfectly finished, thereby permitting the drawing in of cable without abrasion or damage to the outer covering; it is not affected by the destructive electrolytic action of railway return currents; it is not expensive, is easily installed and is a very durable device. The conduit is manufactured by special machinery, also designed by Mr. McRoy.

A very extensive and interesting exhibit of central station and street railway supplies and house goods was made by the People's Electric company of Madison, Wis., and is illustrated on this page. This supply house was organized in October last by L. W. Burch, who was for a number of years a traveling salesman for one of the Chicago houses. Mr. Burch has associated with him in his new enterprise F. H. Ford, a graduate of the University of Wisconsin, who is secretary and electrical engineer, and L. W. Kroncke and P. F. Harloff, who were formerly electrical contractors in Madison. The exhibit was of a character that displayed a thorough knowledge of what was best in the supply line and was displayed to great advantage. The company, on account of the personal acquaintance of its president, Mr. Burch, with all the central station managers and electricians in the Northwest, has been enabled to secure some of the best specialties in the supply line. Among those of special interest were the Columbia lamps, Wagner transformers, Paiste & Co.'s full line of porcelain cut-outs, sockets, switches, arc lamp projector, Hart switches and Bryant goods. Seven fine large photographs illustrated the "Northern," motors and dynamos manufactured by the Northern Electrical & Manufacturing company in its new works at Madison, Wis. The Standard telephone was to be seen, and was thoroughly examined and explained and pronounced to be a winner by all those interested in telephones. Some 50 samples of overhead line material for street railway construction showed to what extent the Badger overhead line material had grown; the People's company carries a full line of these goods. Besides the specialties mentioned, a complete line of house goods was shown, including the People's carbon battery, Capital dry battery, "Our special" soldering pot, Sure-grip tape, Grimshaw and Raven core wire, Coe's electric mail boxes, etc. The untiring effort of the president to explain his display, introduce strangers and make the convention a success, so far as it was possible, made it manifest to the central station men that the People's company would be a good place to send an order. The energy and intelligence displayed are certainly deserving of success, and according to their books, Mr. Burch says, the balance is decidedly on the right side. A number of good agencies were secured.

## The New President of the Northwestern Electrical Association.

William Bryan Baker, who was elected to succeed Mr. Grimm at the Milwaukee convention, was born at

WILLIAM BRYAN BAKER, THE NEW PRESIDENT OF THE NORTHWESTERN ELECTRICAL ASSOCIATION.

Racine, Wis., in 1859, and there completed his education in the Academy of Col. McMynn, father of John C. McMynn, a well-known member of the Northwestern association. At the age of 20 he went to Marshfield, Wis., and entered the employment of W. H. Upham, now governor of Wisconsin. Later, upon the organization of the Upham Manufacturing company, he was elected treasurer, which position he held until 1887. In that year he severed his connection with the company and went into the banking business at Waupaca, Wis., where he now resides. As cashier of the National Bank of Waupaca he has won for the institution a reputation making it first in Waupaca county.

In 1891, with Irving P. Lord, Mr. Baker purchased the electric lighting plant at Waupaca, the business of which has been built up in a very satisfactory manner. The plant is small, but well constructed and managed. It is run by water, and the power is transmitted through a Sampson wheel driving a 1,500 light Wood alternator and a 65 light Brush arc machine.

Before engaging in the electrical business Mr Baker had no practical knowledge of electricity, but, with remarkable aptitude and good financial ability, he has made a success in the central station business. Soon after entering this new province he saw the advantages of an organization of central station managers and electrical men in the Northwest. When the project was broached he at once interested himself and devoted much time and labor to the accomplishment of the organization of the Northwestern Electrical association. In its infancy the organization seemed "born to die," but by the indomitable perseverance of a few men like Mr. Baker, it revived and grew into its present state of prosperity. Mr. Baker has before been urged to accept the office of president, but has hitherto modestly declined.

EXHIBIT OF THE PEOPLE'S ELECTRIC COMPANY AT THE MILWAUKEE CONVENTION.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

E. T. Jones, who has been in charge of the crew at work on the Northwestern Telephone Exchange company's system in St. Cloud, Minn., has been transferred to San Antonio, Tex.

I. F. Strauss is an applicant for a telephone franchise at Janesville, Wis.

The Fairmont Telephone company of Fairmont, Minn., has been incorporated.

The Commercial Club of Mankato, Minn., is considering an offer from the Blue Earth Valley Telephone company of Winnebago City, Minn., to put in a telephone exchange there, if $2,000 to $3,000 worth of stock is subscribed.

Telephone connection between Washington, Ia., and Brighton and Fairfield will be made soon.

The Black Hills Telephone company of Deadwood, S. D., is having considerable trouble with its lines in various parts of the Hills. It is supposed that wind storms are the cause of the trouble.

The Oshkosh Northwestern Telephone company of Oshkosh, Wis., has begun operations with 200 subscribers.

The Forman Telephone company of Forman, N. D., contemplates extending its line north from Lisbon in the spring, and would go via Buttzville to Enderlin, if given encouragement.

It is believed that the Northwestern Telephone Exchange company will soon have to make a central office of its exchange at Red Wing, Minn., which is now run on the individual plan, as the subscribers are becoming too numerous for that system.

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## HIGH WATER MARK

CIRCULATION, 16,630.


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AS USUAL, the annual report of the Board of Railroad Commissioners of New York contained recommendations for the amendment of the railroad law compelling the use of fenders on surface cable and electric cars and generally regulating the operation of such roads as to the use of air or power brakes, but the companies seem [illegible] than they were a year ago.

JUDGING from the sensational yarns that have appeared in the daily newspapers of the country during the last two weeks, Tesla must have added a press agent to his staff. It would be unjust to hold the celebrated inventor responsible for the nonsense that has been printed about him and [illegible] and extensively copied throughout the country. We would [illegible] authorized statement by Tesla himself.

[illegible] people. Accordingly the taxpayers by an overwhelming majority voted to sell the plant. Is it not too bad that the city of Chicago cannot dispose of the street lighting equipment with which it is encumbered? No doubt considerable difficulty would be experienced in finding a purchaser, as under Barrett's administration the plant has so depreciated as to be of little value to any commercial company.

ABOUT this time of the year it is customary for large corporations to hold their annual meetings, submit to their stockholders a report of the business transacted during the preceding twelve months, and formulate a policy for the ensuing year. In the reports of the meetings of this character that have appeared in the daily papers, it is noticeable that there is marked improvement in tone, based upon the present condition of the market and the signs of returning confidence that can be seen on every side. In the electrical industries there seems to be an almost universal impression that the coming year will see a revival of prosperous times. A great deal of construction work is already in sight; many projects that had to be temporarily abandoned two years ago on account of the hard times are showing signs of returning animation; the manufacturers and dealers are giving evidence of renewed interest in life, and altogether there is an air of confidence displayed in the trade that affords positive relief after the struggle for existence which many have been forced to keep up during the last two and a half years. Let us hope that the present year will fulfill all our expectations and repay us in part at least for the trials and vexations that we have been compelled to bear. Surely there is reason to be encouraged.

WITH the adoption of the trolley for the Clark street line it was thought that John P. Barrett would realize that his opinions were not respected in Chicago. It will be remembered that the business men and property owners on that thoroughfare co-operated with the Chicago City Railway company, notwithstanding "Professor" Barrett's strenuous efforts to get an underground system adopted. The underground scheme was dead from the moment it received the Barrett endorsement.

This, it would seem, ought to wind up the "professor" as far as the Chicago street railroads are concerned. He recommended an underground system to President Yerkes of the North and West Side companies, and was turned down; and then a similar fate befell him at the hands of the South Side company. Alas, alas! how great were the days which have departed!

It may have been the example of the two old companies that influenced the action of the General Electric Railway company last week in determining the system of propulsion to be employed upon the lines for which franchises were recently given. The promoters of the enterprise started out with the idea of building an underground conduit railway, but in an evil hour they consulted Barrett and secured his "endorsement" of the plan. Then their troubles began. It was only when Barrett had been disposed of and the plans which he approved had been discarded that fortune again smiled upon the project. From these facts it is easy to draw this valuable lesson: If you have a project which you desire to succeed in Chicago, get J. P. Barrett to condemn it. If you want your venture to meet with a storm of opposition, get the "professor" to indorse it.

A POINT raised by Mr. Cunningham in his paper before the Milwaukee convention last week was the desirability of engineers and designers of station apparatus and construction giving more attention to the improvement of the steam plant, the boiler and engine equipment, and the general plan of construction and arrangement, instead of devoting all their time to increasing the efficiency of the electrical apparatus. A source of great trouble and annoyance to station managers has been, he says, lack of availability, or, in other words, lack of systematic arrangement of dynamos and engines which, no matter what may happen, will enable them still to carry their load, furnish light and power to customers and drive electric cars without interruption. In Mr. Cunningham's estimation this lack of availability resulted from having too great a variety of machines. For instance, he says, we have a machine for incandescent lights, a machine for arc lights, a machine for power service and a machine for railway service. What is needed is a universal machine, and then by suitable transforming, rectifying, phasing devices to accommodate the current to all sorts of uses to meet the wants of the consumer. He suggests as a means for insuring absolute reliability, that the station be so designed, the dynamos so connected to engines, that, with a capacity of say one-third more than the largest load, the company can always be in position to assure its customers constant service. Practical experience has convinced him that greater possibilities are open to designers of stations of this type than to those studying along the line of higher electrical efficiencies.

DEVELOPMENTS in street railway circles in Chicago last week will have a far-reaching effect upon the industry in every part of the country. It is announced upon what may be considered excellent authority that the street railway lines for which the General Electric Railway company secured franchises in the Chicago City Council two weeks ago will be equipped with storage batteries. Until the ordinance, as passed by the council, was printed in the daily papers, it was understood by those interested in the project that an underground conduit electric system would be introduced, but, as was pointed out last week in these columns, the ordinance did not restrict the company to the underground system. This discovery was followed by the announcement that a trolley line would be built. Now one of the gentlemen interested in the enterprise has given positive assurance that the line will be operated by storage batteries, that the contracts have been awarded for the construction and equipment of the road, and that ample financial backing has been secured by the men now holding the franchise. In deciding upon the form of equipment the capitalists interested were guided somewhat by special conditions which confronted them. The consents of property owners had been secured with the understanding that an underground system would be installed, but the particular type proposed is untried, and consequently purely experimental. They were not satisfied with the operation of the underground systems at Washington and New York, believing that they would require much improvement and radical changes before becoming commercially successful. They believed, too, that public confidence would be gained by adopting an entirely different system from that of the Chicago City Railway company, thus impressing the people whose support they sought that it was a live and earnest competitor of the old corporation. It is believed that the new lines will be operated in conjunction with the Englewood & Chicago Railroad company, and will thus give that important system down-town connections that will prove very valuable.

STREET railway companies throughout Illinois will be interested in the proposition to bring them under the control of the state railroad commission. At the next meeting of that body a test case against the Chicago General Railway company will be argued, and as there are several important legal points involved, the hearing will doubtless attract considerable attention. The extension of the powers of the commission to include street car lines depends on the decision as to what law is applicable to them. Most of the lines are incorporated under the "horse and dummy act," which does not provide for the use of electricity as a motive power. Some of the roads might claim exemption under their special charters. The law under which the commission would exercise control is the general railway act of 1873, the application of which has been occasionally admitted by street car lines when it was to their interest to invoke its protection. The present case is directed against the Chicago General Railway company because that road is in sympathy with the purpose, and will give the case a fair test. C. L. Bonney, one of its owners, has had in mind for some time the introduction in the Legislature of a bill including street railroads within the jurisdiction of the commission. Under the complaint to be presented, the defendant road is charged with extortion. On January 15th the complainant, whose name has not yet been disclosed, boarded a car at Twenty-second and Throop streets and rode east to the river, a distance of less than one mile, paying five cents for the transportation. The maximum rate of fare allowed by the commission is three cents a mile. For this reason, and on the further allegation that on the same day and on the same line passengers were carried a distance of five miles for five cents, the railroad is charged with extortion and unjust discrimination. For the violation of the law, provided that it is held that the company comes under the provisions of the railway act, the corporation is liable to a fine of from $1,000 to $25,000. In many other ways a check would be exercised on the street railroads if they were under the jurisdiction of the railroad commission. Reports of all accidents would be required and general regulations imposed. It is not to be expected that other street railway companies will let a decision be made without taking a hand in the fight.

## Modern Apparatus vs. Existing Conditions.[1]

By W. J. Buckley

Two things are constantly changing the conditions of your plants, namely, the development of new apparatus and the reduction in price of supplies.

The money earning station fits its apparatus to its service, not the service to the apparatus. If you charge $10 a month for a 2,000 candle power arc lamp and your customer regards you as a robber, it would seem expedient to furnish either a smaller arc or a big incandescent lamp service at meter rates, thus reducing the price, but not the proportionate profit.

A big cut in your 2,000 candle power rates will transform that service into a non-paying investment, while a service of half the candle power at half the cost of production will pay a profit.

The big incandescent lamp is a money-making factor ignored by a majority of operating stations, either through lack of knowledge or appreciation of the fact that efficient 100 to 500 candle power lamps are selling at a price that commend their use.

Unless you are running a modern plant, it costs $6 per month to produce and maintain a 2,000 candle power arc lamp. This applies to the average station, and will be believed by the stockholder who has been in business long enough to see his intended investment enlarged, his plant rebuilt and his prospective profits used up long before they reach him in the form of a cash return, in expenditures necessary to meet unlooked for changes or unwelcome competition. One of the chief elements of the latter is the Welsbach burner. This competition you have met in your various ways; yet you are all doubtless impressed with the fact that it has come to stay; not perhaps in its present form, but in a new and improved burner which eliminates some of the many glaring faults of the original. The quicker this competition is met, the easier and cheaper it is overcome.

But how?

Many men of many minds would have as many answers.

The president of the Calumet Gas company of Chicago, operating the second largest arc plant in this country, thinks the strongest competing service is an arc system in "blocks of five"—500 candle power arc lamps, $\frac{5}{16}$ carbons, $5 per month, five per cent. discount when paid within five days after the first of the month.

In this consideration we may assume: First, it is unnecessary to bodily buy the gas company, or, secondly, sell your holdings at a sacrifice. If you can sell at a price and will not, we take it that you are running your station for the sake of your health, in which event, the Welsbach burner becomes a mere diversion breaking the monotony of an otherwise peaceful life.

The Welsbach fad strikes a town over night and goes through it like measles. It lasts about nine months, will usually displace one-third of your lamps in service, which, owing to the many objections of the burner, developed in its use, gradually return like lost sheep to the fold until the former output is reached, if not passed, by the demand created for a more liberal illumination.

The first change found necessary in your operation is to increase the candle power of your lamps to a competitive brilliancy. When 16 candle power lamps sold at 85 cents this might prove disastrous, but with better lamps at 18 cents a piece, it becomes a necessary virtue. This will not decrease your profits as much as your first thought might suggest, for the increased voltage will run your meters fast enough to make up the added expense, provided you sell your current through meters. If you do not do so, the added revenues of those who do, would suggest that you climb in the band wagon and buy meters for your entire equipment. It is a money earning proposition to you and the satisfaction to your customer, who is pleased with his daily inspection of current used, even if the meter is 25 per cent. too busy.

In this connection the advisability of accurate switchboard instruments and their periodical calibration with a standardized instrument is clearly shown, as a comparison of the station output with the receipts will immediately uncover any leakage in the revenue.

The increasing of your pressure will disclose, if your experience has not already proven it, the inefficiency of small transformers of any make. The ground losses on the line and the copper and iron losses in the transformers of the ordinary alternating station are uselessly and unnecessarily large. Four out of seven stations tested by me in the last three months for their constant load loss have shown that less than two-thirds of the current generated reached the lamps. One station employing a 90 kilowatt, 1,800 light, 1,000 volt alternator, with 1,842 lamps wired, gave an output of 70 amperes at the switchboard when 840 lamps were burning. The lamps, which were all of one make, were counted between the hours of 7 and 8 P. M., when the customers were requested not to turn off or on any lamps in that interval. The test showed that current for 1,400 lamps had generated at the station with a constant load loss of 28 amperes. This loss should not exceed eight amperes. The current at the switchboard running 840 lamps should have registered 50 amperes, all of which would indicate that this station ran with a constant load loss of 20 amperes, or current enough to supply 400 16 candle power lamps, for which the station received no pay. This useless loss was eliminated by putting triple petticoat porcelain insulators in place of the single petticoat S. G. glass, removing one fixed and one intermittent ground on the line and changing 1,400 lights of 5, 10 and 25 light 50 volt transformers to two 250 light, eight 100 light and two 50 light 100 volt transformers. The balance, of 400 lights, was on the residence circuit and were changed from 50 to 100 volts without materially decreasing the size of the transformers. When these changes were completed the output at the switchboard was 51 amperes with 808 lamps burning. While formerly most of the output was sold at a given rate per lamp per month, when the change was made every lamp was put on meter, and the losing station converted into a paying property.

Increasing the candle power will apply to the same extent in meeting ordinary gas competition. We know the public is willing to pay a fourth to a half more for electric light than gas, provided they get full candle power. Taking gas and incandescent lamps at equal candle power the equivalent rates would be as follows:

| | | | | | | |
|---|---|---|---|---|---|---|
| Gas at $1.00 | per thousand | equals | 16 c. p. | lamps at | ½ c. | per hour |
| " 1.50 | " | " | 16 " | " | ¾ c. | " |
| " 2.00 | " | " | 16 " | " | 1 c. | " |

This presumption will certainly leave a fair margin of profit on a competitive basis, as the life of the incandescent lamp cuts but one-fifth the figure it did four years ago. The pioneer usually forgets this change in lamp values, and through force of habit and training keeps down the incandescent candle power,

A new rule hung on the switchboard should read: "Keep up the candle power to keep your job."

The following table of efficiencies of 100 volt 16 candle power lamps is the result of a test made with some of the prominent makes:

| | | | |
|---|---|---|---|
| Thomson-Houston ..... | .62 amp | 62 watts | 3.875 watts per c. p. |
| Edison ................ | .55 " | 55 " | 3.437 " " " |
| Buckeye .............. | .56 " | 56 " | 3.500 " " " |
| Packard ............... | .57 " | 57 " | 3.362 " " " |
| Bernstein ............. | .65 " | 65 " | 4.062 " " " |
| Beacon ................ | .54 " | 54 " | 3.375 " " " |
| American .............. | .58 " | 58 " | 3.625 " " " |
| Columbia .............. | .61 " | 61 " | 3.800 " " " |
| Keystone .............. | .56 " | 56 " | 3.500 " " " |

The price delivered and the guaranteed life are other points which decide the preference, but I hesitate to include the life test through a dislike of a probable criticism of advertising some particular lamp; and again each batch of lamps filling a given order from almost any maker seems to vary from the average life of the preceding lot.

The "New Lamp," like the "New Woman," will curtail the material used in its construction and produce more effect with a given energy.

A lamp having a life of 500 hours and taking 2½ watts per candle power at 18 cents apiece, or still better, a 300 hour two watt lamp, will greatly increase our competitive strength.

The contingency arising from an opposition plant entering your field with neither your permission nor pleasure is, of course, governed by local conditions and your judgment.

Filled with Chesterfieldian courtesy you might introduce the enemy to your customers and also show him your earnings from the starting of your plant. Not only would your sincerity be doubted but he would believe you made twice the profits shown; and that if you did not that he could; and even this belief would be direct-coupled with a mental pity of how much you have yet to learn in your business. You might even allow there was room for two, or you might conclude to let him go ahead and hang himself on his own proposition. Meantime it is demoralizing your customers, dividing either your business, your profits, or both, and, worst of all, constantly reducing the fixed valuation of your property.

Referring again to the Calumet Gas company, as a successful fighter of competing plants, I will add that this company has but one rule—fight from the shoulder. Drop the prices down at one stroke to a point where the other fellow must lose. Deprive him of all revenue and he is forced to quit. This rule has placed the price of 1,200 candle power arc service in certain districts of Chicago at 10 cents per night, $2.60 per month.

It may be expedient to state that the Calumet Gas company has money and a modern plant. If you have neither, the value of fighting from the jump is not altered, as it forces you to draw on other resources to modernize your station, a good thing in itself, or without resources it compels a more liberal and immediate purchase of your plant.

To-day power, arc and incandescent service is produced from the same machine, and any agreement to divide the service is liable to daily abrogation.

The best protection to the value of your property and its revenue is to keep it modernized. This contemplates a continuous expenditure anticipated and met by the money earning plants.

The development of the business has demonstrated the economy of large units. In arc service the 100 to 125 light machines have displaced the 35 to 50 light units with a saving in maintenance of 40 per cent.

In direct current service the large units effect a saving in maintenance of 20 per cent., which is increased up to 50 per cent. by being direct-connected.

In alternating current service, the large units effect a less apparent saving in current efficiency, but the slower speed, lower temperature and ability to run continuously makes their adoption a commercial gain, apart from the simplification of circuits.

Speed and weight should govern the price of all types. A dynamo running at 600 revolutions weighs nearly twice as much as one of the same design and rated capacity at 1,200 revolutions. It costs 70 per cent. more to build. Hence, a direct-connected dynamo at 275 revolutions is worth 70 per cent. more than a belt-driven machine of the same design at 550 revolutions. When the armature is built directly on the extension of the ordinary engine shaft, this may be reduced to 50 per cent., on account of the doing away with one box, pedestal and part of the frame.

Suppose a purchaser wants a direct current belted machine of 100 horse power, or 1,000 lights capacity. He finds the cheapest type a bipolar machine, say with a speed of 1,200 revolutions, weight 6,000 pounds, price $900, average efficiency 80 per cent., with an armature life of two years if loaded. In the multipolar machine he finds the high speed belted dynamo at 1,100 revolutions, weight 6,500 pounds, price $1,000, same efficiency and life as bipolar, the medium speed dynamo at 550 revolutions, weight 11,000 pounds, price $1,400, 85 per cent. efficiency, armature life five years, the slow-speed 275 revolutions, weight 17,000 pounds, price $2,200, 87 per cent. efficiency, armature life eight years.

Thus we have dynamos of the same make, if you will, and each of the same rated capacity in horse power, lamps or kilowatts, ranging from $900 to $2,200 in price, the more expensive machines not always receiving at your hands the consideration they deserve.

The dimensions of the base frame of any dynamo will show when too great a preponderance of weight is delegated to that inanimate object.

Again, the rating given a dynamo by the maker should not always be accepted. The various machines offered should be placed on the same basis of estimating their capacity, namely, assuming the highest point of efficiency as full load, the added capacity of the machine beyond that should be regarded as an overload. Most dynamos are rated at their utmost capacity, irrespective of efficiency or temperature.

A 150 kilowatt alternating dynamo rated at 130 amperes and 1,150 volts is worth but 86 per cent. of one of equal quality rated at 150 amperes and 1,000 volts; the first being the output at the dynamo, the latter the output at the center of distribution, where it belongs.

This difference in actual value is reduced to 75 per cent. if the first dynamo is rated at full capacity and the latter at its most efficient output.

It may be a question of the value of money to you whether you can afford to buy slow-speed machines at their increased cost.

The Harrison street station of the Chicago Edison company has shown an extraordinary reduction in cost of current per kilowatt hour by the use of direct-connected machinery, but the units are from 500 to 1,500 kilowatts.

A fair estimate of the added saving in the use of direct-connected apparatus would be a 100 kilowatt machine, 10 per cent.; 200, 20 per cent.; 300, 30 per cent.; 500, 40 per cent.; 1,000, 50 per cent.

In buying arc apparatus the speed and weight should also govern in nearly the same degree the price of the largest size you can use. The pressure which reaches 6,500 volts in a 125 light arc dynamo seems to be carried on the ordinary arc circuit as easily as 3,000 volts. Of course, 6,000 volts will jump nearly twice as far, and theoretically would require twice the insulation to hold but experience has shown that if an overhead arc line is built to protect a pressure of 3,000 volts, it will carry 6,000 volts with safety. No reliance whatever is placed upon the insulation of the ordinary No. 6 overhead arc line, which should be erected as if the wire was bare, as almost all such lines five years after erection are bare so far as insulating qualities are concerned. The weak spots requiring increased insulation are the wires from the pole to the lamp or entering stores. Beginning then at the pole, these wires should be a high-grade rubber insulation. The regular weatherproof line wire will give a constant trouble even when protected with porcelain or hard rubber bushings or flexible tubing. It is not necessary to use rubber insulation throughout your overhead arc line, even with 150 light arc machines.

When the purchaser comes to buy alternating apparatus he is confronted with single-phase, quarter-phase, two-phase, three-phase, multiphase and moncyclic—surely enough to feaze him to start with.

But what system will fit his conditions? Which machine should he buy?

With the use of an efficient motor the single-phase is the ideal alternating current system. No condensers, no balancing of the load, no fixed arbitrary line loss, but two wires on the line, all giving a flexibility that affords a minimum cost in power, arc and incandescent services from the same machine and circuit.

All the catalogues of multiphase apparatus contain statements, variously expressed, that a single-phase synchronous motor is the most desirable but unattainable type. This is no longer true as to its unattainability. Single-phase motors are now sold on the market, having as high a commercial efficiency as is obtained in any but the large types. They are self-starting at full load with maximum torque. They require no special circuits or connections, no starting rheostat, no condenser and no special transformer, the ordinary lighting transformer answering the purpose. Being in step with the generator, the regulation of the synchronous motor is perfect under all loads, and the motor will pull out of step and stop running if more than a 50 per cent. overload is applied.

What is a single-phase dynamo? It is a machine wherein the number of coils in the armature equal the number of pole pieces in the field. The armature coils have the same "pitch" as the pole pieces. The "pitch" is the distance from the center of one field pole to the center of the next. The coils are connected so that the armature contains but one circuit or ring of coils.

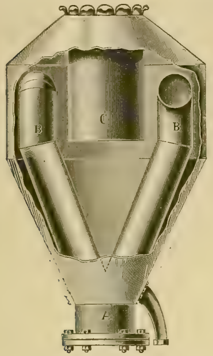
The two-phase dynamo means that there are twice the number of coils in the armature that there are poles in the field, having half the pitch of the pole pieces. The armature is split in two, and instead of every coil being connected on one circuit, every other coil is connected together, so that the armature presents two independent circuits or rings of coils. It is practically two armatures in one field, each having its separate circuit for service.

1. Read at the annual meeting of the Northwestern Electrical association at Milwaukee, Wis., January 15-17, 1896.

Lamps may be tapped from either circuit, and one half the armature may be cut out and the other half run on a single-phase; but all four wires comprise the power circuit and must be connected to each motor. This means four wires throughout on your poles. Both circuits may be tapped indiscriminately for light and power, but in doing so they require the same hand regulation at the station to constantly balance the load that is usually given the three-wire direct current system. Two legs of the circuit may be one wire of a nearly equal cross-section, so that the three wires require practically as much copper as the four.

In the three-phase dynamo the armature coils are three times the number of poles and represents three separate circuits or rings of armature coils having one-third the "pitch" of the pole pieces. The number of phases by reducing the line induction especially fit the three-phase system for the transmision of very large powers over very long distances, and the current may be delivered on not less than three and as many as six wires, depending on the fluctuations and proportioning of the load in the different services.

Monocyclic is different only in the method of connecting and proportioning the armature coils and is to all intents and purposes an unbalanced three-phase machine, unless we assume that the placing of the teaser coil in the middle of the main coil of the armature does not split these coils in two, in which case it becomes an unbalanced two-phase machine, as the teazer coil, while having wire of the same cross-section, is but one-fourth the size of the main coil. The armature coils equal the number of pole pieces and are of the same "pitch," and the teazer coils, being wound in the opposite direction, are connected one end to the middle of the main coil circuit, the other end to the third collector ring, making a three-wire circuit, this arrangement being slightly modified to include a commutator for compounding the field to compensate for line loss.



VACUUM EXHAUST PIPE HEAD.

When the dynamo is intended for lighting service only, the third wire may be dispensed with and the machine run as an ordinary single-phase machine, but with a consequent reduction in efficiency caused by the idle teazer coils.

When the dynamo is intended for power only, the three line wires must be of the same cross-section and all three wires must be in service.

When power and light are both run, the so-called teazer line wire only can be reduced in proportion to the power service, although the full cross-section of wire is usually advocated.

A quarter phase dynamo is a two-phase machine with the coils set one fourth or 90 degrees ahead of each other.

You are all familiar with the difference of cost in erecting and maintaining two or more circuits instead of one, or three wires instead of two; but some buyers neglect the consideration of this expense until their multiphase apparatus is purchased, when it confronts them with the nasty familiarity of the unexpected expenditure so usual in disbursing our wonderfully over-estimated receipts.

[illegible]

[illegible]

[illegible]

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able than a single-phase is in the transmission of very large amounts of power over great distances, and where the power is distributed in several units.

After the phases the important consideration is the number of alternations or the frequency.

The market apparatus of various makes gives 16,800, 15,000 and 7,200 alternations, or the product of the number of poles multiplied by the speed per minute.

An alternation is the traveling of a current through the circuit in one direction; and when it has completed its journey in the opposite direction it has made a complete period or cycle. Two alternations make a cycle; hence 16,800 alternations per minute is 8,400 cycles per minute, or 140 cycles per second; 15,000 alternations per minute, 125 cycles per second, and 7,200 alternations per minute, 60 cycles per second.

Why do different manufacturers make machines and transformers with different phases and alternations? First, the opinion is offered that it is to have something new, implying an improvement to talk up and advertise; something different to that which the other fellow sells. Secondly, because low frequency machines are cheaper to build. Thirdly, because different frequencies affect in different degrees the power, incandescent and arc services.

Generally speaking the higher the frequency the better the lighting service. The frequency of 3,600 alternations per minute, or 30 cycles per second, is suitable for power only and will not commercially operate an arc or incandescent service at all; because the low period current waves produce an undulating and decidedly fluctuating light.

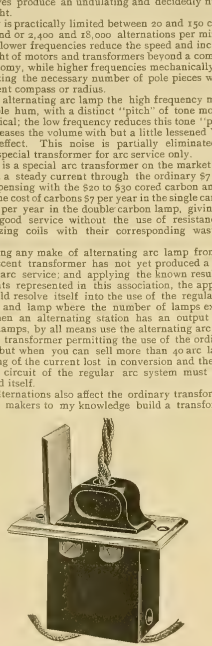
Power is practically limited between 20 and 150 cycles per second or 2,400 and 18,000 alternations per minute, because lower frequencies reduce the speed and increase the weight of motors and transformers beyond a commercial economy, while higher frequencies mechanically prevent getting the necessary number of pole pieces within an efficient compass or radius.

In the alternating arc lamp the high frequency makes an audible hum, with a distinct "pitch" of tone more or less musical; the low frequency reduces this tone "pitch" and increases the volume with but a little lessened Wagnerian effect. This noise is partially eliminated by using a special transformer for arc service only.

There is a special arc transformer on the market that will feed a steady current through the ordinary $7 carbon, dispensing with the $20 to $30 cored carbon and reducing the cost of carbons $7 per year in the single carbon, and $14 per year in the double carbon lamp, giving an equally good service without the use of resistance or economizing coils with their corresponding waste of energy.

Running any make of alternating arc lamp from the incandescent transformer has not yet produced a competitive arc service; and applying the known results to the plants represented in this association, the application would resolve itself into the use of the regular arc dynamo and lamp where the number of lamps exceed 40. When an alternating station has an output of a few arc lamps, by all means use the alternating arc with a special transformer permitting the use of the ordinary carbon, but when you can sell more than 40 arc lamps the saving of the current lost in conversion and the single-wire circuit of the regular arc system must then commend itself.

The alternations also affect the ordinary transformer. But two makers to my knowledge build a transformer



IMPROVED ATTACHMENT PLUG.

especially for 7,200 alternations. All the other manufacturers build a transformer designed for high frequencies, and without altering the patterns or construction beyond a few trivial changes to make room for the necessary added ampere-turns of wire, offer a transformer presumably suitable for any frequency.

How does this affect the man who buys transformers? If he has a high frequency current, this type of transformer will consume 50 per cent. more magnetizing current than one designed only for high frequency.

If he applies the high frequency transformer to the low frequency current, the lack of necessary ampere-turns of wire or weight in iron makes the loss in magnetizing current still greater and the transformer mighty hot.

The quick repair transformer, wherein the iron field is split in two so the coils can be readily replaced, is too dear at any price, the broken magnetic circuit causing too great a loss of current in energizing the transformer, apart from the charring of the insulation by the excessive heat generated.

It is an apt illustration of the eternal fitness of things that the electrical apparatus built to repair easily soon develops a determined disposition to accommodate you.

Summing up the brief opinions offered might suggest to the members of this association who are probable buyers of new apparatus:

First—If the amount and valuation of your money will permit, buy direct-connected apparatus.

Second—If your means or present arrangement of power suggests the purchase of belt-driven dynamos, buy the heaviest slow-speed machine of the largest capacity practicable.

Third—Use 2½ watt lamps; two watt if you can buy them.

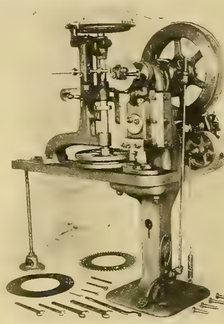
Fourth—If your power service is in small motors, none of which are larger than 50 horse power, use single-phase. apparatus; if in motors larger than 50 horse power, use multiphase.

Fifth—If the proportion of lights is greater than power, buy high frequency apparatus; if power is the most important service, buy low frequency.

Sixth—Use the largest transformer practicable having the best regulation consistent with minimum loss on no load.

Seventh—Sell all your current through meter and check up the station output with your receipts.

These suggestions numerically arranged, like the



AUTOMATIC INDEXING MACHINE FOR NOTCHING ARMATURE DISK

commandments, will not be taken, I trust, as advice. Advice is the cheapest thing I know of, and I value my opinions too highly to offer them to any but those who choose to entertain them.

## Improved Attachment Plug.

As shown by the cut, the improved plug attachment for electrical circuits herewith illustrated is made to be flush with the wall or floor when the plug is not inserted. A lid is furnished to conceal the place where connection is made, and the fixture can be finished to match the decorations of the room. This device is strong and durable and has been approved by the fire underwriters. It is made by William Pringle & Co., 1026 and 1028 Filbert street, Philadelphia.

## Vacuum Exhaust Pipe Head.

Steam users will be interested in the simply arranged exhaust pipe head and roof protector herewith illustrated. The device is placed on the market by I. L. Faucett of Quincy, Ill., who claims that it is noiseless and unequaled for either high or slow-speed engines. There are no hoods or deflectors, and an unobstructed steam outlet is provided, thereby avoiding back pressure. The water of condensation is separated from the steam by centrifugal force. In other words, this pipe head directs the condensation in a whirling motion against the internal surface near the top, from which point it passes down the casing and is discharged without re-entering or passing through the escaping steam. The device is neat and ornamental, and is built on practical and scientific principles. It is sold on a 30 days' test.

## Automatic Indexing Machine for Notching Armature Disks.

The demand for electric motors has made it necessary for electrical manufacturers to obtain special machinery for producing the several parts accurately and expeditiously. The Farracute Machine company of Bridgeton, N. J., has for some time been building automatic indexing machines to cut the notches in the sheet-iron disks which form such an important part of the electric motor. It has recently improved its indexing machine,

and the accompanying illustration represents this useful machine as now built. The improvements recently made enables the machine to be run at a much higher speed than formerly. The moving parts have been carefully redesigned, with a view to reducing the momentum by means of lighter chucks, spiders and dials. A new leather brake has been added, and a rigid connection between the frame of the press and the frame of the indexer is also a new feature. The eccentric has been moved 90 degrees to the right upon the main shaft, which makes the ram stop half way down, thus obviating the violent jerk to the indexing arrangement at the starting of the clutch.

The machine has also been improved in a number of minor details, such as the use of rubber strippers on the punch, giving more friction room for getting the work under than is afforded by the stationary metallic stripper. There is also an adjusting ring screwed into the die chuck, by means of which the die can be regulated. The machine is provided with an adjustable brake under the bottom of the pintle of the lower gripping chuck. A most important improvement consists of a device for lowering the ram suddenly in relation to the pitman and shaft, while the press is in action, the object of this device being to allow the press, with its dial, etc., to be set in motion at a very high speed by means of the treadle, and, while running, have the punch brought down into working position. The consequence is a uniform indexing of the notches, which is not disturbed by the stopping and starting of the press, an evil which sometimes occurs by the old system. This machine has been successfully run at a speed of 200 per minute. Of course this speed is not practicable when the notches are far apart, but can be approached very closely in ordinary work.

A machine of this nature obviates the necessity of having an expensive pair of dies for cutting out the notched disk entire or by notching the circles one notch at a time by hand, the latter method being slow and inaccurate. By means of the machine shown in the picture the manufacturer has only to provide circular disks, place them in proper position between the dies, depress-

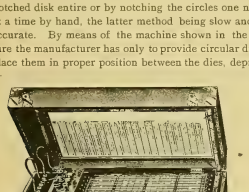


FIG 1. SCALE WIRE BRIDGE.

ing the treadle, and the machine does the notching, cutting one, two or three notches at a time, and running the disk around automatically until completed. This machine will notch disks up to a diameter of 36 inches, which will cover the needs of most manufacturers. An advantage of this machine is that one dial, with a given number of teeth, will cut any diameter of disks within the 36 inches mentioned.

Among other advantages of this system of indexing is the ability to use a large diameter of dial, with consequent accuracy, on account of its being placed above the frame of the press, so that in many cases it is larger than the disk to be cut. This construction enables a very small chuck to be used, with consequent small diameter of disks. The adjustment to change disks can be made in a few minutes, as can also the change from one number of teeth to another. Duplicate dial-wheels can be furnished afterward with any number of teeth required. These can be slipped on in a few seconds, and can be adjusted in a circumferential direction so as to locate the notches to agree with key-seats, etc. The number of teeth in the disk is the same as in the dial-wheel, or any lesser number which is a perfect divisor of that number. The whole attachment can be taken off in a few minutes, and the press used for ordinary work. The illustration shows an electric motor in position, driving the fly-wheel of the machine.

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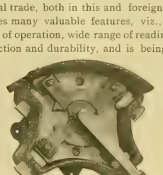
The *Electrical Engineer* of London is entitled to congratulations on the very marked improvement in its mechanical make-up.

## Improved Arc Cut-out.

The illustration shows an improved arc cut out manufactured by the Philadelphia Electrical & Manufacturing company, 2010 Jones street, Philadelphia, Pa., for which the Metropolitan Electric company, Chicago, is the western sales agent. The construction of this cut out is such that many points of superiority over other makes are claimed. Some of these are, durability, safety, neatness of design, etc., and while it is comparatively new to the western trade, it has established for itself an enviable reputation in the eastern and middle states. It is fire and moisture proof and is spoken very highly of by the fire underwriters.

## Scale Wire Bridge.

A portable bridge and testing set is being brought out by the Buffalo Instrument company of Buffalo, N. Y., which is meeting with considerable favor among the electrical trade, both in this and foreign countries. It embraces many valuable features, viz., simplicity and rapidity of operation, wide range of reading, simplicity of construction and durability, and is being placed on the



IMPROVED ARC CUT-OUT.

market at a figure which should bring this class of instrument into more general use.

Fig. 1 shows the instrument as it is in general outline. A description is necessary to show its design of construction. The variable resistance of the bridge is composed of a continuous scale wire, 500 inches in length, stretched around suitable insulated pins at each end of a table. Upon the table is a chart divided into 1,000 half inches; each half inch is divided into 10 degrees, which virtually divides the scale wire into 10,000 separate units or degrees. This chart simply divides the entire length of the scale wire into 10,000 separate units or degrees for convenience in reading the scale in making measurements.

The standards of resistance or multipliers of the bridge are one ohm, 10 ohms, 1,000 ohms and 10,000 ohms respectively. The standards are calibrated to embrace one-half of the scale wire, 5,000 units or degrees of the scale (from *A* to *B*, Fig. 2), while the other side of the coils is connected to a multiplier post *D*. The standard would be from letter *K* to *J* to *D*. The unknown is across the remaining leg of the diagram (from *D* to *X X*).

One side of the receiver or galvanometer is connected to *D*, the other side of which is at *C*, which is a finder or contact to be used in tracing the neutral point over the scale (between *X X* to *B* and *A*). The battery connects between points *J* and *X X*.

To find the neutral point, take the finder or pointer *C* and draw it over he manifolds of the "scale wires." It is readily determined on which wire the neutral point lies, as the receiver indicates a sharp, loud sound, except when at the neutral point or close to it, when it becomes weaker and finally is silent directly at the neutral point. Readings taken with this style of receiver have proved to be fully as sensitive as the ordinary galvanometer, and in many instances much closer results have been obtained with it, where the galvanometer remains dull from foreign forces, etc.

The chart under the scale wire gives the degree of the scale. By referring the degree of the scale to a chart contained in the cover of the instrument, there is found the direct reading of resistance of the bridge, from .0001 ohm to 99 megohms. This obviates all necessity of figuring the resistance from the standards.

It will be noticed by this method of measurement that a person of ordinary intelligence and without practical experience in the use of a bridge cannot fail in making an accurate test.

## Dayton Gas Engine.

This engine, which is herewith illustrated, is put upon the market by the Dayton, O., Gas Engine & Manufacturing company as a strictly high grade engine for gas

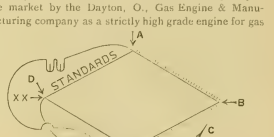


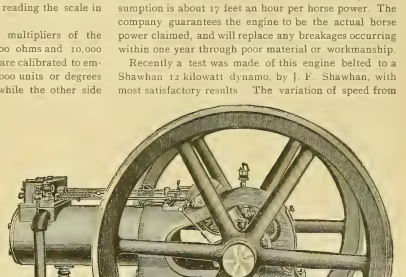

FIG 2 SCALE WIRE BRIDGE

or gasoline. The engine has an iron base and is very compact. The crank shaft is covered to protect the surroundings from grease. Either gas or gasoline can be used through the same apparatus. The working parts are simple, complete, accurate and all on top, where they can be easily reached. The valve stems have double bearings, making their alignment perfect. The gasoline enters the cylinder in the form of perfect gas without the aid of gravity or force pumps, and the gasoline tank is lower than the inlet, thus avoiding danger of flooding. The valves are of the poppet type, and each valve is worked positively and directly from the cam shaft, by means of a separate stem with double bearings keeping them in alignment. The cylinder and explosion box are both water jacketed, without having any packing whatever between the cylinder and water chamber. Should it ever become desirable to throw a belt on or off the main pulley, the speed of the engine can be reduced almost to a stopping point, the belt can be replaced, and the engine speeded up again without stopping. The engine can be arranged to increase or diminish its speed at will, while it is running, and will continue to run at that speed until another change is desired.

It is built for electric ignition, but can easily be changed to tube ignition, whenever it is prefered. All of the oil cups can be filled while the engine is running.

The cost of running with gasoline is about one cent an hour per actual horse power, and the natural gas consumption is about 17 feet an hour per horse power. The company guarantees the engine to be the actual horse power claimed, and will replace any breakages occurring within one year through poor material or workmanship.

Recently a test was made of this engine belted to a Shawhan 12 kilowatt dynamo, by J. F. Shawhan, with most satisfactory results. The variation of speed from



DAYTON GAS ENGINE

no load to full load was only 3.4 per cent., and the apparatus gave no trouble whatever. Mr. Shawhan considered the test to be "exceedingly satisfactory."

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In the forthcoming book of contributions on "One Hundred Years of American Commerce," edited by Chauncey M. Depew, the writers of the distinctively electrical sections are: "The Telegraph," Gen. Thomas T. Eckert; "The Telephone," John E. Hudson; "Electrical Manufacturing Interests," T. C. Martin; "The Street Railways of America" are described by H. H. Vreeland of New York, and "Machinery Manufacturing Interests" by William Sellers of Philadelphia.

## Chicago Surface Railway Reports.

The Chicago City Railway company gained much traffic through the operation of electric lines in 1895. The annual report at the stockholders' meeting shows an increase of $150,653 in net earnings after the payment of all fixed charges and cost of reconstructing a portion of the cable system. In 1895 the company converted 69 miles of horse-car lines into electric lines and increased its mileage of electric roads 70 miles. Electric lines now make up nearly three-quarters of the South Side system. It is chiefly through these lines that the road was able to make a better showing than in 1894. Last year $1,300,000 was expended in the construction of new lines and the conversion of horse-car lines into electric lines. Under city ordinances the company must build 8.12 miles of road by July 16, 1896, and 19.7 miles in 1897 and 1898. The number of revenue passengers carried during the year was

| | Per cent. | Number |
|---|---|---|
| Cable lines | 60.09 | 53,359,829 |
| Horse lines | 7.79 | 6,918,616 |
| Electric lines | 32.12 | 28,528,016 |
| All lines | | 88,806,461 |

An increase over 1894 of 4,011,474, divided as follows

| | | |
|---|---|---|
| Increase on electric lines | | 19,013,201 |
| Decrease on cable lines | 1,330,979 | |
| Decrease on horse lines | 13,670,748 | |
| | 15,001,727 | |
| | | 4,011,474 |

The total earnings were $4,476,824 and the cost of operation, including insurance and taxes, was $2,807,726, or 62.72 per cent. of the total receipts. The net earnings were $1,368,709, or 14.41 per cent. on a capital of $9,500,000. A dividend of 12 per cent. was paid. The net loss on horse lines for the year was $122,241, caused by loss on large number of horses disposed of on a stagnant market and the transfer to electricity of revenue-producing lines. The total number of car-miles run was 21,941,900. Compared with 1894, the increase of car miles on the electric lines was 3,676,500 and the decrease on the cable lines 358,820. The cost of operation per car mile was: Cable, 10.24 cents; electric, 14.77 cents; horse, 30.55 cents. Several new lines, for which franchises already have been obtained, will be built this year, and to meet the cost of this construction the stockholders empowered the directors to increase the capital stock $2,000,000, to be subscribed for at par by the stockholders. President Wheeler said that the first call for subscriptions probably would be made in July. Work on the new lines will be begun early in the spring.

The North Chicago Street Railroad company had an excellent year in earnings. The receipts from passenger traffic of the system amounted to $2,694,359 and receipts from other sources $86,128, making a total for the year of $2,780,487. The operating expenses aggregated $1,312,107, and the fixed charges, including interest and rentals, $471,251, making the total expenditures $1,783,359, leaving as the net earnings, for the 12 months covered in the report, $997,127. There was paid out in dividends to stockholders $659,922, leaving $337,205 to be added to the surplus, which at the beginning of the year amounted to $1,357,075. This gave a total surplus of $1,694,281, from which an extra dividend amounting to $1,100,000 was given stockholders, leaving the surplus at the close of the year $594,281. The receipts of the cable lines amounted to $1,632,797 and the expenses $651,942, leaving as the net receipts $980,855. The receipts on the electric lines amounted to $670,284 and the expenditures $303,136, leaving as the net receipts $367,148. The receipts from horse-car lines amounted to $391,276 and the expenditures $357,028, leaving as the net receipts only $34,248. The operating expenses of the North Chicago Street Railroad system amounted to 48.70 per cent. of the gross receipts, as compared with 54.33 per cent. for the preceding year. The cost to each passenger carried, figuring only operating expenses, [illegible] cent. The net earnings of the company [illegible] 12 per cent. of the capital stock. During the year 1895 about 58 miles of track was changed from horse to electric track, so that at the present time the tracks [illegible] of 17 miles of cable, [illegible] miles of electric and [illegible] of horse-car track. President Yerkes [illegible]: "It was not until the year was more than half spent that we were running the electric lines under fair conditions, and since the commencement the improvement has been rapid and steadily to the advantage of the public and the company. The last few months have clearly demonstrated to the management the wisdom of the change [illegible] that the future will demonstrate [illegible] the money [illegible] earned, but that the people are given much [illegible] satisfactory service, both as regards rapid transit and shorter time between trains. Electric lines encourage the growth of the country, and not only increase the value of the property, but improve the quality of the buildings which are erected in the new neighborhoods through which they run. That the change from horse power to electric has been, even under the disadvantages which surrounded the change, a great benefit to the road, is shown by the fact that the percentage of expenses to the gross receipts was 48.71 per cent., against 54.33 per cent. last year."

The report of the West Chicago company showed that the gross earnings of the company were $4,201,477 and the total operating expenses $2,267,195, leaving as net earnings $1,934,281. The balance as shown in the statement applicable to dividends amounted to $1,032,266. The amount of dividends paid was $791,340, leaving a balance to be carried to the surplus account of $240,926, which gives as the total surplus at the present time $1,722,619. The West Chicago street railroad last year changed from horse car to electric lines a large amount of track. Previous to the extension of the electric lines the company had a total of 157 miles of horse-car lines and 30 miles of cable track, or a total of 180 miles. Of the horse-car lines 108 miles have been equipped with electricity, and more than 13 miles of new line have been built. At the present time the company has a total of 201 miles of road, of which 49 are horse-car, 121 electric, and 30 miles cable. The cost of motive power decreased from $756,768 in 1894 to $526,698 in 1895.

The Chicago General Railway company carried 1,746,112 passengers in 1895 (an increase of 83 per cent. over the preceding year) and reported net earnings of $17,748.21.

## Storage Battery Railway for Chicago's Down-town Business District.

Within a year Chicago will have a storage battery street railway line penetrating the down-town business district and connecting with the projected extensive system of storage battery lines in the South Side suburban district, if the plans of the gentlemen who have secured control of the General Electric railway ordinance are executed. It will be remembered that the consents of the property owners for that ordinance were obtained with the understanding that an underground system, the "Brandenburg under-car," would be used. When the franchise was put through the council it became known that the ordinance did not restrict the promoters to the use of the underground system—the trolley and storage battery being also permitted, if found desirable. The mayor disapproved the ordinance, and the council promptly passed it over the veto. Last week the promoters of the enterprise succeeded in attracting capitalists to the scheme, and it is now announced that plenty of money has been provided for building and equipping the line. The gentlemen now in control have determined to put in storage batteries instead of an underground system. Contracts have already been placed for building and equipping the line. C. E. Loss & Co., Chicago, will build the road, and the Electric Storage Battery company of Philadelphia will supply the accumulators. Work will be begun immediately, it is announced, and in less than a year it is hoped the line will be in operation. The route of the new line, as set forth in the ordinance, is as follows:

Beginning at Twenty-third and Dearborn streets, north in Dearborn street to Fourteenth street, east in Fourteenth to Plymouth place, north in Plymouth place to Jackson street; also in Custom House place from Jackson street to Fourteenth street, east in Fourteenth street from Custom House place to Dearborn street.

Also, beginning at Twenty-third and Dearborn streets, south in Dearborn to Thirty-seventh street, west in Thirty-seventh street to Fifth avenue, thence south in Fifth avenue to Forty-third street, west in Forty third street to Princeton avenue, south in Princeton avenue to Forty-seventh street.

Also, beginning at Wabash avenue and Fifty-seventh street, west in Fifty seventh street to Morgan street, north in Morgan street to Fifty-sixth street, west in Fifty sixth street to Western avenue.

With the right to connect the same with the other street railway tracks and loops now or hereafter owned or operated by or in connection with said company. Permission and authority are hereby granted, if desired, necessary or convenient to connect with or cross the viaduct in Twelfth street at grade with driveway, and to construct all necessary viaduct approaches thereto.

It is announced that this line will probably be operated in conjunction with the Englewood & Chicago system, which it was recently decided to equip with storage batteries. This will give Chicago an extensive storage battery traction system.

## Why Folks Read Business Papers.

By N. C. Fowler, Jr.

Business people read business papers. He who can't get business out of the business paper has no business to be in business, and generally isn't. The daily paper has its business department. The religious paper recognizes business. The business paper is all business, for it can contain nothing excepting that directly pertaining to the business it represents.

The business paper is the distributer of hard business literature. The business paper is the periodical clearing-house in which is made the balance of trade. The business paper increases trade, regulates competition, protects industries. It is a protective organ, as well as a medium for the distribution of unpolitical free trade.

I do not mean to say that all poor business men do not read trade papers, but there never was a good business man who did not depend upon the paper of his trade. Perhaps the trade paper editor may not have been drilled in the business he represents. Perhaps he may have been a failure as a business man. It is not the business of the business editor to be a success in business. It is his business to act in the capacity of the absorber of business information, that he may the better present, with or without argument, the data of business.

Into the trade paper goes the theory and practice of business manipulation. It is a mirror of business. It reflects trade directly. It does not allow the rays of business to diverge from the straight line of trade.

The business man may read an hundred daily papers, or he may read a dozen magazines, and from them all he may obtain general information of positive value in the conduct of his business; but from a good trade paper he receives definite, practical information of as much importance to him as the counter in his store, or the record book in his office.

Folks read business papers because they want to. Folks read business papers because they have to. The first indication of intelligent progression in the clerk is when he turns from his desk at opportune moments to absorb the paper of his trade.

The intelligent man of business reads his trade paper from begining to end, advertisements and all. He may not always read it intelligently, but he gives to every page at least an eye-glance. The advertisements to him are of the same importance as the reading matter. In the combination of the two he derives information of pertinent necessity to the management and development of his business.

The trade paper is a necessity, and so long as it occupies that position it will be read conscientiously and intelligently by every business man who has proven his right to do business.

## Chicago Telephone Companies.

The annual report of the Chicago Telephone company for 1895 contains the following figures: Gross earnings, $1,759,752; net earnings, $542,838; dividends, $455,544 (on a capitalization of $3,796,200); surplus, $87,294. The net earnings increased $34,262 over 1894. It is reported that the capital stock will be increased $1,000,000. George M. Pullman was elected a director in place of John B. Drake, deceased.

The Central Union company did not do so well, as the opposition of anti-Bell companies has cut down its net earnings $50,823 from the amount of the year before. The 1895 figures are: Gross earnings, $1,345,233; net earnings, $355,165; dividends, $330,265; surplus, $24,900. It is stated that the company has used its surplus in extending its business, and that it borrowed $300,000 in 1893 and $500,000 last year.

## Electricity for the Lake Street "L."

The experience of the Metropolitan road shows that on an elevated railroad the expense of electrical operation averages 45 per cent. of the gross income. Figuring on this basis and the present business of 35,000 passengers per day, President Louderback of the Lake Street Elevated Railroad company, Chicago, estimates that the change from steam locomotives to electric power on that road will cause a saving sufficient to show an annual net earning of $362,312. This will meet the fixed charges of $280,237, and leave $82,075 for the stockholders, changing the road from a losing venture to a profitable one. According to the annual report, contracts have been let for equipping the road with electricity, at an estimated cost of $240,410, which will include car barns and repair shops to house 48 cars.

A second electric light and power plant is rumored for Winona, Minn.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, January 18. The Rapid Transit Commission of Inquiry is still taking testimony to show the value of Chief Engineer Parsons' estimates of cost. Most of the engineers who have testified think that Mr. Parsons' figures are too low.

The Board of Railroad Commissioners has granted permission to the Metropolitan Street Railway company to adopt the underground electric system on its Lexington avenue line between One Hundred and Fifth street and the Harlem River, and on the Twenty-third street line between the North and East rivers.

On Wednesday the rehabilitated works of the Crocker-Wheeler Electric company at Ampere, near Newark, N. J., which were destroyed by fire on April 7, 1895, were thrown open for inspection to invited guests. The company makes electric motors and dynamos. A peculiarity of the works is that there is no shafting or belting in the entire place, each machine in the works being directly driven by an electric motor. Each lathe, drill, planer or other machine has a small motor connected with it. The power house, with engines aggregating 325 horse power, stands some distance from the main works, the electric conductors being carried from it through an underground tunnel. The main machine shop of the company is 450 feet long by 100 feet wide and is traversed from end to end by an electric traveling crane with a lifting capacity of 20 tons. A large number of visitors inspected the works, and on Thursday many members of the American Society of Civil Engineers visited the works.

The advocates of the new gas, acetylene, are encountering the opposition of the underwriters here. The *Tribune* states that the Board of Underwriters has issued a special circular to the effect that it will refuse insurance on buildings using acetylene gas. This action was taken upon the report of Professor Henry Morton of Stevens Institute. Professor Morton, on being interviewed in Hoboken, stated for publication his grounds for an unfavorable report. He explained that pure acetylene was not explosive, but when mixed with the air it was extremely so. "The Fintsch Light company," said Professor Morton, "while experimenting with acetylene gashad an explosion which I believe will be repeated very frequently under similar circumstances. They charged a cylinder with gas with only 90 pounds pressure, according to the gauge. Suddenly the head blew out and crashed through the roof, went up into the air, and then fell back, demolishing a chimney. You can see for yourself how unsatisfactory any gauge must be in case of acetylene, for 90 pounds pressure could hardly cause such an explosion. However, I do not believe that calcium carbide, from which acetylene gas is made, can be manufactured at a price which would make it available. It will cost at least $100 a ton. Even if it can be manufactured in such a way as not to be explosive, the cost must be reduced to $15 a ton to be used as an enricher. I will not say that there is absolutely no use for the new gas, for at present it is wholly in the experimental stage."

It is expected that the first trolley car built for the purpose of shunting trains at the terminals of the Brooklyn Bridge will be ready for trial on Wednesday of next week. If it is demonstrated to the satisfaction of the bridge trustees that a car fitted up with an electric motor can be used in place of the locomotives now used to switch the cars at either terminus of the bridge, a dozen more cars will be equipped in the same way and the locomotives will be sold. The officials of the General Electric company claim that the trolley car will be of greater utility than the locomotives, and that one of these cars when loaded with passengers will have sufficient power to haul three other loaded cars up the bridge incline. It will also do away with the nuisance of smoke, steam, cinders and noise caused by the locomotives. The Nassau Electric Railroad company has made a proposition to operate electric cars across the bridge to supersede the present service. President Flynn offers to pay for the expense of an impartial investigation of the subject by three competent engineers in the United States service. W. F. O.

### Buffalo and Niagara Falls.

BUFFALO, January 18.—Attorney Herbert P. Bissell of the Buffalo Traction company denies the report that the Buffalo Traction company is seeking admission to Niagara Falls. "We are not seeking to enter the Falls by this route or any other one," he says. "We have bought the Buffalo, Kenmore & Tonawanda line, as has already been stated. That takes us to Tonawanda. I have heard nothing of our going to the Falls."

Secretary W. B. Rankine, of the Cataract Construction company, arrived in Niagara Falls on Tuesday and announced that the company had accepted the Buffalo power franchise. He made this announcement after a meeting of the board of directors had been held at the power house. The resolution adopted by the board has been forwarded to City Clerk Hubbell. The board also formally authorized the signing of a contract with the Niagara Electro-chemical company. Bids for the extension of the wheel-pit have been opened in New York, but the contract has not been let, although it is expected that it soon will be. The price to be charged for the power in Buffalo was not given out. It is said it will remain a secret for a while yet. It is stated that the price will be considerably more than is charged for power in Niagara Falls. During the last few weeks the company has made contracts to supply several large manufactories which are to be built here. They being the first to come, their wants will have to be attended to first. It is promised that the work of the enlargement of the plant will be pushed forward rapidly now.

The Gorge Railway company has been granted a right of way through Walnut and Second streets, Niagara Falls, by the Common Council, but there was considerable annoyance felt by Superintendent Brooks and others of the Gorge company at the tactics adopted by some of the property owners to shut this company out of town. After Mr. Brooks had agreed to pave the streets through which tracks are to be laid, and put in curbing and catch-basins, it was thought that would end the matter and that the grant would be given the company. But it was not so. Notwithstanding the lateness of the hour a question was raised regarding the hours during which workingmen's tickets would be accepted, and a long discussion followed. Charles. F. McKenna, a property owner, also raised a point regarding the construction of a loop on Prospect street, and Attorney Lawrence, who represents the Gorge company, found it a difficult task to explain and agree to matters that the company had so suddenly been confronted with. About 11 o'clock the members of the council got tired of the talk and ordered that the company be given the right of way it had asked for. This was done after a clause had been inserted in the franchise placing the fare through the city at 5 cents, and workingmen's fares between the hours of 6 and 7 A. M. and 6 and 7 P. M. at 2½ cents.

F. C. P.

### Northwestern Notations.

MINNEAPOLIS, January 17.—The Deadwood and Delaware company of Deadwood, S. D., will light its smelter with electricity, putting in 100 lights.

A mass meeting of citizens at Farmington, Minn., appointed a committee to investigate the cost of an electric light plant.

Fred A. Wachter, a tie and pole dealer of Oshkosh, Wis., secured an attachment against the Central Electric Railway company of that place for $4,280, claimed to be due for material.

The Kenosha Electric Light company of Kenosha, Wis., has filed notice of dissolution.

The aldermen of Mankato, Minn., and the Mankato Gas & Electric Light company officials got together informally to discuss what the former wanted in connection with the recent advertisement for proposals to put in a street and commercial lighting plant and operate street cars, for which there were no bids. The aldermen generally wanted about five miles of street car line, and 80 arc lights of 2,000 candle power.

The city electric plant at Chamberlain, S. D., is now being operated by artesian well power.

It is rumored that H. B. Laughlin, manager of the Fisher, Minn., telephone system, is considering a stock company to put in an electric light plant.

The council of Madison, Wis., passed a resolution directing a committee to ascertain what a municipal electric light plant would cost.

The Northern Pacific Railroad company is rebuilding its telegraph lines through to the coast. It completed about 200 miles in Washington last year. There is outlined for this year about 225 miles of line east of Helena, Mont., to be rebuilt.

William H. Merrill of Chicago recently addressed the Commercial Club of St. Paul, dwelling on the careless way in which a great deal of the electric wiring in that city is done, and upon the dangers attendant. The club, after his speech, appointed a committee to send a resolution to the council on the matter of an electrical inspector.

I. B. Walker, superintendent of the Sioux City Traction company, has invented a brake for electric street cars which is said to be simple and effective in its workings. J. A. McCrosky, an expert electrician from the Westinghouse Electric company of Pittsburg, was recently sent to Sioux City by the company to examine the appliance. He expressed himself as well pleased with it.

An electric railway company has been incorporated to build an electric railroad from Milwaukee to Racine and Kenosha, Wis.

The electric light company at Oshkosh, Wis., objects to paying a bill of the city's for boxes which were burned out, claiming that a telephone wire broke, crossing the electric light wire and a city wire, causing the boxes to burn out. The matter will probably be compromised.

M

## ELECTRIC LIGHTING.

The village of Lowell, Mich., has employed Humphrey & Carr of Detroit as engineers for the construction of its electric light and power plant. The electrical machinery will be located eight miles from the village and driven by water power.

## MISCELLANEOUS.

The National Association of Manufacturers is holding its first annual convention this week in Central Music Hall, Chicago.

The Chicago Mineral and Mining Board has been organized for the purpose of centering in Chicago the business of developing the mineral resources of the country. The office is in the New York Life building.

The regular weekly issue of that excellent journal, *The Iron Age*, for January 2d, contained 128 pages of "reading matter" and 160 of advertisements—a truly remarkable showing. *The Iron Age* is 40 years old, but entirely modern and progressive.

## TELEGRAPH.

The Rocky Mountain Postal Telegraph company has been organized in Helena, Mont., for the purpose of competing with the Western Union Telegraph company for western business. The new company has a contract to purchase the Rocky Mountain Telegraph company, which now owns and controls 365 miles of lines in Montana. Projectors of the new company have been in Chicago for several days perfecting arrangements with the Postal Telegraph-Cable company.

## TRADE NEWS.

The Adams-Bagnall Electric company of Cleveland has opened a New York office at 1302 Havemeyer building. A. D. Dorman is in charge.

J. H. Burgbardt, who has been identified with the Boston office of the Page Belting company, has been made general manager of this concern, with headquarters at Concord, N. H. Mr. Burgbardt is widely known as a pushing salesman and business man, who will add much to the business department of the Page Belting company.

An attractive pamphlet setting forth the merits of the Standard water-tube safety boiler, with a full and well illustrated description, is issued by the Standard Boiler company, 1120 Marquette building, Chicago. The advantages claimed for this boiler over the ordinary type lies in its economy in the use of fuel, its freedom from possible explosion, and in its perfectly free and unrestricted circulation, and the ease with which any part may be examined for cleaning and repairs. The Standard is offered as an improvement over any existing type, having all the good features of the older styles, and many others which are peculiar to itself. Standard boilers to a total capacity of 4,000 horse power are installed in the power station of the North Chicago Street Railroad company.

General Manager W. E. Gray, of the Campbell & Zell company of Baltimore, Md., reports that during the past year the business has increased so rapidly as to tax the works to their full capacity. This concern has recently closed the contract for the boilers for the Maryland & Columbian railway and the new electric road between Baltimore and Washington. There will be two power houses, one at Hchester and another at Hyattsville, each to contain 3,000 horse power boilers of the Zell improved water-tube safety boilers, there being 10 boilers in each installation. The competition for this order was exceedingly lively, and extended over several months, in which time very close investigation was made into the merits of the many firms who bid for this work; and it is stated that experts prominently known were employed especially for this purpose. Among duplicate orders recently taken the company mentions a fourth order from the Maryland Electric company, Baltimore, of 560 horse power; a fourth order from the City & Suburban Railway company, Baltimore, of 754 horse power; a third order from the William Henderson Sugar Refinery, New Orleans, La., of 500 horse power; also one of 500 horse power from the St. Charles Hotel, New Orleans; one of 300 horse power from the Botsford Paper Mill company, Kalamazoo, Mich., and one of 600 horse power for the new Olympia Theater, New York. It has also just installed a 117 horse power high-pressure boiler to work at 200 pounds pressure for the Baltimore Chrome Works, and several days ago re-

ceived an order from the Richmond, Va., Traction company for 500 horse power of boilers.

The Standard Telephone & Electric company of Madison, Wis., begins the year 1896 with a record of over 60 exchanges equipped during the last year, all of which are in successful operation. Recent installations are at Menomonie, Wis.; Marquette, Mich.; Wausau, Wis.; Merrill, Wis., and in Madison, Wis., where one of its model trunk-line switchboards of 1,000 drops capacity is in operation with 500 lines connected. The company closed contracts for complete equipments at Jacksonville, Fla., Parsons, Kas., and several minor points last week. The promoters of this company have appreciated the vital importance of turning out apparatus adapted to meet the most exacting requirements of exchange and long-distance service. The company is the sole licensee for the sale of the Milde microphone transmitter in the United States, and has up to this time sold over 10,000 of these instruments, which are noted for simplicity, small dimensions, entire multicontact and powerful transmission. The new telephone, now ready to be placed upon the market, embraces new features whereby simplicity, efficiency and durability are increased—the new generator has high voltage and large quantity; the polarized bells have centrally pivoted armatures, and the telephone switch is simple and positive in action and prevents burnouts of induction coils and receiver, which will be highly appreciated by old telephone men. The new bridging bells, with centrally pivoted armatures, have high co-efficient of self-induction. The new standard switchboards are complete in every respect, durably made, handsome in appearance, rapid and efficient in operation, and embrace several new features.

## BUSINESS.

The De Lamater Iron Works of New York, manufacturers of hot air pumping engines, have removed from the foot of West Thirteenth street to 87 and 89 South Fifth avenue, in that city.

A. D. Sill, Elgin, Ill., manufacturer of telephones and telephone appliances, also does all kinds of telephone repair work, such as rewinding burned-out 'phones, changing magneto into electric 'phones, etc.

The Electric Appliance company, Chicago, has covered the western states with a calendar that is unique and artistic in design and contains a moonlight schedule that will be found particularly useful to station managers.

W. W. McChesney, Jr., representing Huebel & Manger of Brooklyn, was in Chicago last week. Mr. McChesney is making a tour through the western states and so far has found business excellent. He secured a number of good orders for Huebel & Manger's well-known bells and other electrical specialties during his stay in Chicago.

The Emerson Electric Manufacturing company of St. Louis reports orders for three switchboards during the last week, one of them being the fifth board by one company in a period of two months. This company's new standard blade-knife switches are capturing the business in this line. If quality and price count, the Emerson people expect to keep this up through the year.

Among the recent installations of Kester dynamos in Chicago is a 600 light machine, driven by a 60 horse power Ball engine, at the Plzensky Sokol building. The entire plant was installed by Richards & Meacham, 86 La Salle street, general electrical contractors and agents for Kester dynamos. The firm reports several important plants which are about to be equipped with Kester machinery.

The Metropolitan Electric company, Chicago, reports that it is still receiving letters of congratulation from all parts of the country on its catalogue. This catalogue seems to have taken the electrical trade by storm, and all pronounce it the largest and most complete electrical catalogue yet issued. The company reports the business outlook for '96 to be very encouraging. William H. McKinlock, president of the company, is in the East on a business trip.

A correct map of any state in the Union to anyone that will send for it, is the generous promise that is made by President A. G. Davis of the Viaduct Manufacturing company of Baltimore, and the large amount of requests which this concern has received in response to this offer would indicate that it will have to enlarge its supply in the near future. This company is having a large business and meeting with the success which has always attended it in the past. With the new factory at Relay in operation it can take care of the rapidly increasing trade.

James E. Woodbridge, for many years at the head of the small tool department of the Pratt & Whitney company of Hartford, Conn., has recently acquired an interest in the Brady Manufacturing company of York and Washington streets, Brooklyn, N. Y., as its president. It is now the intention of the Brady company to take up the manufacture of a full line of small tools of every description, in addition to its regular business of special automatic and labor-saving machinery, special tools and fixtures, including complete plants for the manufacture of specialties.

The Standard Boiler company of Chicago reports a good business during the last year. It has moved into its new offices, 1120 and 1121 Marquette building. These boilers are built by the well-known Link Belt Machine company, which has put in new and improved machinery for their manufacture, reducing the prime cost as well as making the various parts interchangeable. During the year a number of fine plants have been installed, including 4,000 horse power for the North Chicago Street Railroad company at the new power station at Hawthorne avenue; 500 horse power for the Cincinnati Edison company at Cincinnati, O.; 600 horse power for the Western Electric company at its factory in Chicago, and various others. Prospects for the coming year are good.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued January 14, 1896.*

552,890. Manufacture of Carbide of Calcium. William C. Clarke, New York, N. Y. Application filed August 24, 1895.

The improvement consists in forming around the lower of two vertically disposed electrodes an inclosure greater in diameter than such electrode, charging into such inclosure the material to be treated, and subjecting it to a decomposing temperature by means of an electric current between such electrodes, adding fresh charges of material and separating the electrodes as required to continue the operation and building up the wall of the inclosure as required to contain the material added.

552,924. Electric Releasing Device. Stewart H. Reynolds, San Jose, Cal. Application filed March 13, 1895.

There are included a casing, a bolt movably mounted therein, a latch having engagement with the bolt and arranged to move the same into operative position when actuated, an electro-magnet, an armature for the same arranged to engage the latch and hold the same against movement when the latch is actuated to move the bolt into operative position, the armature being adapted when moved by the magnet to release the latch, and a spring connected to the bolt and arranged to throw the same out of its operative position when released by the latch.

552,933. Electric Bell. Charles B. Sterling, New York, N. Y. Application filed September 3, 1895.

No. 552,890.

The combination is claimed with the gong, the solenoid and the vertically movable core in the solenoid, of a circuit maker and breaker connected to the lower end of the core, stationary contacts insulated from each other to engage the circuit maker and breaker, guides for the circuit maker and breaker, electrical connections between the supply conductors and the contacts, and a rotary break engaging the core.

552,954. Automatic Electric Releasing Device. John W. Chute, San Jose, Cal. Application filed April 16, 1895.

The cut shows an arrangement including a fulcrumed spring-actuated swinging arm, a spring-actuated latch adapted to engage the arm and retain it in engagement, a spring-actuated bell-crank lever fulcrumed with relation to the latching lever so as to strike and disengage it when released, a bell-crank armature carrying lever, together with an electro-magnet which controls the operation of the device.

552,961. Electric Motor. Dugald C. Jackson and Conrad M. Conradson, Madison, Wis. Application filed July 26, 1895.

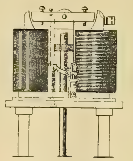
In combination with a hub carrying a bearing and provided [illegible] light plug [illegible] draw-off plug and the [illegible] plug removably and interchangeably fitted to the hub.

552,967. Electric Arc Lamp. Lars G. Nilson, Sioux City, Ia. Application filed July 25, 1893.

[illegible] made for the combination of a main and a shunt magnet, a back yoke connecting the cores of the [illegible] connected with the back yoke and a single [illegible] common to both magnets pivoted to the post [illegible] forming a part of the magnetic circuit of both cores.

552,982. Electric Arc Lamp. Frederick J. Borland, Leeds, England. Application filed August 17, 1894.

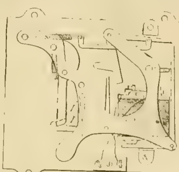
Claim one is given: The combination with a support, a shunt coil and a series coil secured to the said support, a tubular spindle passing through the said coils, and a central core slidable in the said spindle, of the lower lever pivoted to the said support and having its rear end operatively connected with the said core, the upper lever also pivoted to the said support and the toothed intergearing segments secured to the respective levers.



No. 552,967.

553,014. Electric Circuit Connector. Thomas F. Nevins, Brooklyn, N. Y. Application filed May 16, 1895.

Among the claims is that for the combination with a casing containing a rotatable ratchet-toothed cut-out block provided with a central socket, and having contact pieces extending from opposite points in the socket to opposite points on the teeth, and spring contacts connected with the leading in wires, of a connector having a plug provided with diametrically opposite contact strips, and adapted to be inserted into the socket, means for preventing the direct removal of the connector from the casing when an electrical connection is made, and conducting wires secured to the connector and connected to the contact strips.



No. 552,954.

553,061. Trolley Cut-out. Theodore Fletcher, Idlewild, Tex. Application filed March 28, 1895.

A trolley cut-out is described provided with a hanger comprising side pieces and a center piece coupled with the heads of the side pieces and formed with openings in the bottom to permit the heads to drop out of the center pieces, the heads of the side pieces having segmental ribs at the end to engage in segmental grooves in the center piece.

553,099. Bonding Device for Electric Railways. Wilson Brown, Camden, N. J. Application filed May 25, 1895.

A bond terminal having a screw threaded opening lengthwise slotted and means to enter and expand the opening are shown.

552,[illegible]. Telephone Apparatus. Carl J. Schwarz, Akron, Mich. Application filed April 22, 1895.

[illegible] The permanent magnet [illegible] generator organized for the [illegible] winding, a diaphragm forming [illegible] permanent magnet and constituting with the [illegible] the element of a telephone transmitter.

553,106. Automatic Closing Telegraphic Key. James A. Coleman, Perry Station, Canada. Application filed November 13, 1895.

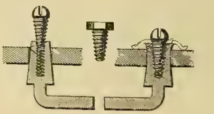
In a telegraphic key the combination of the key lever, a button comprised of two sections, one section connected to the key lever, and the other section movably secured to the stationary section, a jointed lever pivotally connected to the key lever, a contact point carried by the jointed lever, and a connection between the jointed lever and the movable button section.

553,133. Mail Delivery for Buildings. Louis J. Pechner, San Francisco, Cal. Application filed July 17, 1895.

An endless traveling cable is utilized for carrying mail boxes from floor to floor, and this cable is operated by an electric motor that may be started or stopped by the postman.

553,176. Electric Railway. Thomas F. O'Connor, New York, N. Y. Application filed April 2, 1894.

One claim is reproduced: In an electric railway, the combination with a suitable way, of a motor vehicle, a source of power, a reel, an electric conductor on the reel having one end stationary and connected with the source of power, and the other end connected to and moving with the vehicle, and a brake applied to check the reel when the speed of the vehicle is decreased and controlled by the vehicle current.



No. 553,099.

553,179. Telephone Circuit. Edward Slade, Newton, and John S. Stone, Boston, Mass. Application filed July 12, 1895.

Features of this invention are: A telephone exchange circuit extending between a sub-station and a central station, and serving for the transmission of both signals and conversation, a signaling current generator normally in circuit therewith, and a transmitter current generator adapted for connection therewith during the transmission of speech; with a switching device, such as a plug, controlling terminals of the transmitter current generator and adapted to connect the same with the exchange circuit, and subsequently to disconnect the signaling generator therefrom.

553,194. Clip for Supporting Electric Cables. Russell H. Lewis, Providence, R. I. Application filed October 30, 1895.

This device has at one end a tongue, and near the other end an opening and a double hook constructed to support the cable and automatically adjust itself to the cable.

553,198. Automatic Lighting or Extinguishing Apparatus. Samuel C. Stickle, New York, N. Y. Application filed May 10, 1895.

In a main circuit opening and closing device there is the combination of a pair of pivoted arms having contacts secured to their free ends, and armature plates upon their inner sides, electro-magnets for attracting the arms toward each other and forcing the contacts into engagement, a catch and detents for locking the arms in their attracted position, an electro-magnet and armature adapted to unlock the detents and a spring for throwing the arms apart when the detents are released by the electro-magnet and armature last mentioned.

553,220. Electric Lamp Support. James Buckner, Boston, Mass. Application filed June 10, 1895.

The invention consists of a metal post, having a fixed collar near its upper end, a tubular insulator supported by the collar, and having an outwardly projecting flange, a sectional metal sleeve clamped upon the insulator, and the lamp arms or standards secured to the sleeve.

Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, FEBRUARY 1, 1896. No. 5

## Use of Two-phase Alternating Current in Chicago.

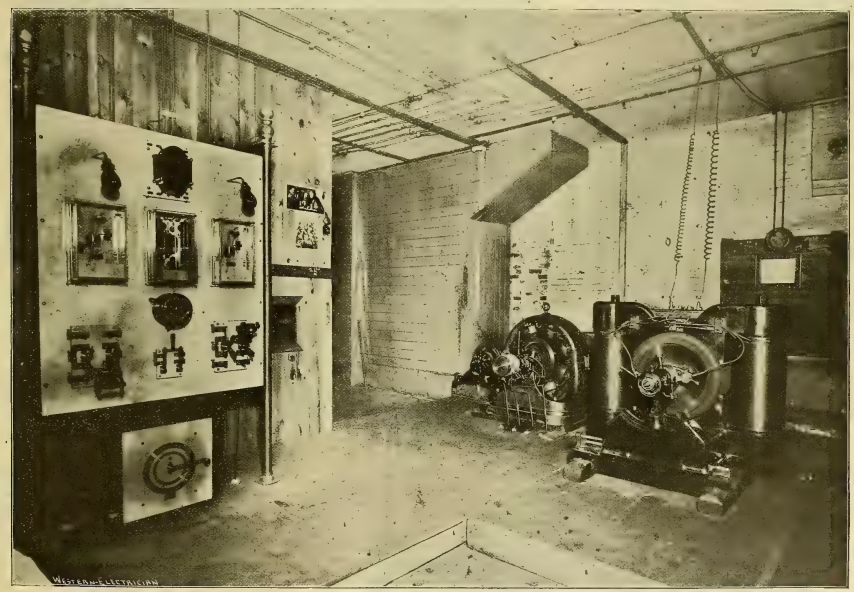
The small central station plant represented by the illustration herewith given is one of a large number of Chicago installations employed in generating current for definite circumscribed districts, generally at some distance from the center of the city. It is owned and operated by Otto von Bachellé at 397 West Madison street, and supplies current for customers in the territory bounded by Center avenue, Monroe street, Ogden avenue and Washington boulevard. It has been in existence about three years, but until recently supplied direct current only, for high-tension series arc lighting. Being desirous of supplementing this service with alternating current that could be used both for incandescent lighting and for power, Mr. von Bachellé recently installed a two-phase machine, and, as this class of equipment is something of a novelty in Chicago, its use renders the modest West Side plant one of considerable interest.

The steam plant consists of one 100 horse power Stirling boiler working at 125 pounds pressure, an Ideal compound engine, with cylinders 10 and 16 inches in diameter and 12 inch stroke, operated at 300 revolutions per minute, a Berryman feed-water heater of 100 horse power capacity and a Deane steam pump. Coal screenings are used as fuel, and the engine drives the dynamos by direct belt connection.

Three dynamos make up the electrical plant. The arc machine is of the familiar upright bipolar type of the Standard Electric company. It is driven at 900 revolutions and is rated as a 55-lighter, but has been constantly overloaded for three years. It speaks well for the machine and for the care taken of it that during this time not a coil has been lost or a cent spent for repairs. Although severely tested, the machine is to-day apparently as good as new. The new two-phase alternator—the middle machine in the picture—is a compact, handsome multipolar machine of 60 kilowatts capacity. It is operated at 900 revolutions per minute, and the current is taken off at the collector rings at 1,100 volts potential and 7,200 alternations per minute. This alternator and its exciter, shown at the left, are Westinghouse machines. The exciter is a small multipolar 125 volt dynamo of 3½ kilowatts. It is driven from an extension pulley on the armature shaft of the two-phase machine Its capacity is considerably in excess of the current needed for the fields of the alternator, and the surplus is partly used for station lighting and is available for charging storage batteries for customers.

One of the most pleasing features of the plant is the switchboard. It is of white Italian marble, four feet wide and five feet high, mounted in an iron frame. The instruments are of the handsome glass-covered type sent out by the Westinghouse company, and the whole effect is a delight to the eye. The arrangement of instruments is as follows: At the top is the switchboard converter; just below an ammeter on each side, one in each circuit, with the voltmeter between; under the voltmeter is the fireproof rheostat controlling the field of the exciter, and below this again is the exciter switch. On either side of the exciter switch is an alternating current double-throw, double-pole dynamo switch, so connected that either circuit can be thrown on either side of the alternator. Underneath the switchboard is the alternating current rheostat controlling the alternating current field and directly in the circuit of the exciter.

The alternating current circuits, one for each phase, lead out of the station overhead to an adjacent terminal box, where the cable (which is of the Standard Underground Cable company's manufacture and was made to order) is connected and runs down into underground conduits which run alongside the curb in the street. This cable is laid up as follows: The insulation is such as to carry under regular work 3,000 volts, and the conductors consist of four No. 6 B. & S. copper wires insulated from each other and twisted together in order to overcome induction; this twisting completely transposes the circuits at very short intervals, doing away with induc-




USE OF TWO-PHASE ALTERNATING CURRENT IN CHICAGO

tion entirely and the consequent choking effect of the iron conduits.

There will shortly be in operation from this station a very interesting combined alternating and direct current power plant, if such it may be called, in the Ashland Hotel, to operate an elevator. This outfit consists of a Tesla multiphase motor, without commutator or brushes, directly connected to a Westinghouse multipolar 150 volt direct current generator. The operation of the plant will be as follows: The Tesla motor will drive by belt the elevator pumps and also the generator to charge a set of storage cells, during the operation of the station, from 3 P. M. to midnight. During the time the station is not in operation the cells will furnish current to the direct current generator, operating it as a motor to drive the pumps until the station generator starts. This is believed to be the first time any combination of this nature has been attempted in this city.

and it will be an interesting and instructive installation when it has been operated long enough to obtain authoritative data.

Mr. von Bachellé is very well pleased with the operation of the two-phase system thus far. He says that the generator requires scarcely any attention at the switchboard, and so far the regulation has been within one per cent. It should be stated, however, that the machine has thus far been run with only partial load. Incandescent lights and induction motors are run from the same circuit with entire success.

## Illumination of the Municipal Casino of Royan.

In the pretty little city of Royan, at the mouth of the Gironde river, France, a grand casino was recently erected on the beautiful beach of Grande-Conche, one of the noted ocean resorts of the country.

The building, which is surrounded by extensive gardens, was constructed by an architect of the government. An idea of the structure and its surroundings can be gained from Fig. 1. The entire structure is lighted by electricity.

A difficulty arose from the fact that there was no adequate supply of soft water for cooling the cylinders of the gas engines, which it had been decided to use for generating the electricity, and a second problem came to the front in the form of that disturbing element, the exhaust of the engines, for the casino is in the midst of the city proper, and bordered on two sides by two of the most fashionable boulevards. Then again there was the trembling of the building to be taken into consideration—a rather serious matter if the vibrations caused by moving machinery were not guarded against.

Fig. 2 shows how the objection to vibrations was overcome. A bed of beton 0.8 meter thick and 1.6 meters deep was built independent of the foundations of the building proper. On this the foundations of the engines were placed, as well as those of the dynamos and motors. The exhaust of the engine is carried into a brick chimney which debouches into a ventilation system terminating in an opening on the roof. At this point a strainer of pulverized coke filters the air, which has come from all parts of the building, before setting it free in the upper air, and effectually quiets the whistling of the exhaust.

The water required for cooling the cylinders of the gas engine is used over and over, because of the scarcity. In the yard next the power house a circular basin (Fig. 3) was constructed with a capacity of 100 cubic meters, with a fountain in the center. Four reservoirs at different parts of the main edifice, for fire emergencies, connect with this basin, so that by means of electric pumps the fountain serves the double purpose of maintaining the water at a proper degree of temperature for cooling the cylinders, and as an ornamental display. These tanks were filled but once for all.

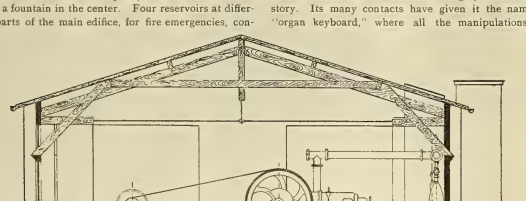


FIG. 2. MUNICIPAL CASINO AT ROYAN.—FOUNDATION FOR MACHINES IN THE POWER HOUSE.

The engine room measures 15.5 meters by 11 meters. The absence of a coal and boiler room materially reduces the space required for the engine plant. The 160 horse power engine is readily attended by one person.

The gas installation comprises three groups, one of 80 horse power and two of 40 (Fig. 4). The 80 horse power has two parallel cylinders, similar to those in use at Reims, Calais, Toulon, etc. Its dimensions are as follows:

| | |
|---|---|
| Cylinder diameter | 0.380 meter |
| Stroke | 0.600 meter |
| Revolutions | 160 |

The 400 ampere 110 volt dynamo, driven by a leather belt, is shown in Fig. 6. The other two engines are single, running at 170 revolutions, each operating a dynamo of 200 amperes of the same type.

The constructors of this machine, having found by sad experience that neither fiber, asbestos nor mica was above suspicion as an insulator, have discarded these and other materials, and have insulated the collector bars by only an air separation.

The three engines are fed by three gas jets of 500 burner-capacity each, at either extremity of the room, connected by a pipe, so that in case of accident to one of these the other would still be available.

These engines have each two heavy flywheels, and the dynamos are furnished with heavy driving pulleys,

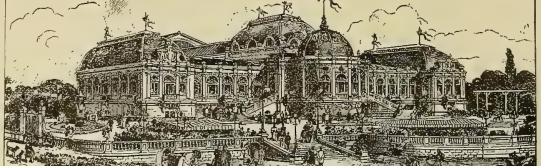


FIG. 1. MUNICIPAL CASINO AT ROYAN.—GENERAL EXTERIOR VIEW.

the result of all of which is to hold the light perfectly steady under all circumstances.

The two smaller dynamos move at a speed of 700 revolutions, and the 400 ampere machine at 600 revolutions per minute.

Fig. 5 shows the plan of the board, with its nine groups of circuits. So much confidence is shown here that there is but a single gas jet in this room, and nowhere can be seen a reserve in the form of a storage battery.

The theatrical board, shown in Fig. 7, tells its own story. Its many contacts have given it the name of "organ keyboard," where all the manipulations required in the show business can be carried on by the electrician of the theater. All the effects of light, sunrise, twilight, night, moonlight, etc., obey the sudden demands of the button or the switch.

The cost of the installation, in round numbers is given by *L'Energie Electrique*, from which the illustrations are taken and the article condensed, as follows:

| | |
|---|---|
| 160 horse power gas engines complete, in place | 60,000 |
| Dynamos, switchboards, etc., in place | 20,500 |
| Water connections, pumps, pipes, etc. | 4,000 |
| Electrical wiring, etc. | 5,500 |
| Total of the installation complete | 90,000 |

The gas meters, for the 75 days from August 25th to October 6th inclusive, showed a consumption of 31,653 cubic meters of gas.

The station record of the electrician showed a service of 29,955.2 kilowatt hours divided thus:

| | |
|---|---|
| For general lighting | 25,530 kilowatt hours |
| Night service | 4,425.2 " " |

This shows a consumption of 1.056 liters of gas per kilowatt hour of electricity consumed.

Calling gas 0.30 per cubic meter, the expense of maintenance, based on these figures, would be for 74 days:

| | |
|---|---|
| Gas—31,653 m³ at 0.30 | 9,495.90 |
| Employes—Electrician and second | 1,500.00 |
| Engineer and helper | 1,500.00 |
| Lamps and carbons | 600.00 |
| Oil waste and tallow | 680.00 |
| Total | 13,775.90 |

The cost then per kilowatt hour would be 0.4 franc. But if the plant is considered as depreciating 10 per cent. per annum, the figures then bring the price up from 0.4 to 0.76 of a franc per kilowatt hour of light.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

Steps are being taken at Manawa, Wis., to form a telephone company to build lines along the Green Bay road to Waupaca, Symco, Big Falls, Marion and Clintonville.

An effort is being made at Hutchinson, Minn., to induce the Northwestern Telephone Exchange company to build a line to that place.

The Wood County Telephone company of Grand Rapids, Wis., has voted to stop all negotiations with the Wisconsin Telephone company and purchase material at once for a new system, on which construction is to begin in the early spring. The company will co-operate with the Wausau and Merrill companies in their fight with the Wisconsin Telephone company.

The Iowa Electric company and the Hess Electric company of Des Moines, Iowa, are behind a scheme to start a co-operative telephone system in Des Moines. They propose an exchange with 1,500 instruments, which they estimate will cost $67,000, with all wires underground, the subscribers all to hold equal amounts of stock. They agree to give service to business houses for $12 per annum, after the system is paid for, and the subscribers are to pay an additional $12 the first four years for a sinking fund.

The telephone enterprise of Louis Vogel and Charles Wagner at Sleepy Eye, Minn., is developing well and the projectors hope to make a success of a system to cover Brown county.

East Grand Forks, Minn., wants telephone connection with Crookston, Minn.

A citizens' mutual telephone company is proposed at North Platte, Neb. The Menominee, Mich., council has granted a franchise to local capitalists to put in a telephone system to connect with Marinette and points in Northern Michigan and Wisconsin.

## Chicago West Side Park Lighting.

Ground has been broken for the new arc lighting station in the northwestern corner of Garfield Park, Chicago, for the illumination of the West Side parks and boulevards. The building and machinery foundations will cost about $40,000. The contract for the conduits, manholes and for setting the poles has been awarded to John Murphy for $9,087.50. There will be 300,000 linear feet of tubing and 128,000 feet of trench

## Some Facts About Acetylene Gas.[1]

By John C. McMynn, M. E.

Acetylene gas has been known for many years as a laboratory product too expensive for anything but experimental use. A possible method of producing this gas on a commercial basis was developed in the electric furnaces of the Willson Aluminum company, at Spray, North Carolina, by T. L. Willson while experimenting with the production of aluminum and the smelting of other very refractory substances, such as lime, silica, calcium, etc., under the direction of Major J. T. Morehead, the president of the company and a geologist of nearly national reputation.

In a recent visit to Spray, N. C., I found a very primitive electric furnace, the current for which is furnished by two 120 kilowatt alternators. The voltage is transformed down to about 100; the carbons are 12 inches by eight inches and 36 inches long, and with between 1,300 and 1,400 amperes the brilliancy and intense heat produced can hardly be imagined unless seen. Finely powdered coke and crushed lime are thrown between the carbons and fused in the intense heat, which results in the production of calcium carbide. This is a black crystalline substance, very hard and insensible to heat' but when placed in water produces a carbon vapor, through the chemical combination of two parts of carbon with two parts of hydrogen, and which possesses the highest illuminating power of any known gas. The calcium combines with the oxygen of the water, thus making a double decomposition.

A company was formed to develop its production and to sell rights for its manufacture. The new product has that these tips will replace the common four or five cubic foot tips, we would have one-half cubic foot giving more light than four cubic feet of common gas. Or 1,000 cubic feet of acetylene giving more light than 8,000 cubic feet of ordinary gas. The average price for gas in the six plants in southern Wisconsin is $1.76 per 1,000 cubic feet, hence the corresponding price for acetylene gas would be $14.08 per 1,000 cubic feet. That is, acetylene gas could give the same amount of light per 1,000 cubic feet for this price. But the fact is that this gas can be produced at any suitable electric plant in southern Wisconsin for a maximum figure of $5 per 1,000 cubic feet.

The gas can be used in several ways:

First—Distribution through mains is not the most advisable method, since leakage would be a large factor and the original investment large.

Second—The carbide can be distributed to residences and a small automatic generator placed in the basement, in which a week's supply could be stored. A house having 20 burners would probably use 10 burners for about four hours per day, and with one-half cubic foot tips would consume 140 cubic feet of gas per week, or about 28 pounds of calcium carbine, at a cost of three cents per pound, would give a gas bill of $3.36 per month, and the house would be much more brilliantly lighted than it could be in any other way except by a larger number of incandescent lights.

Third—A valuable property of the gas is that it will liquefy itself if the resulting gas is contained when water is added. This liquid gas is to be distributed in cylinders similar to carbonic acid gas cylinders (as used for soda water fountains), and when admitted to the house

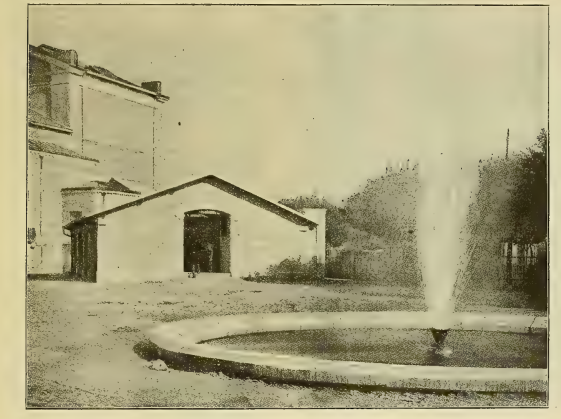


FIG. 3. MUNICIPAL CASINO AT ROYAN.—VIEW OF FOUNTAIN.

than by ordinary gas or electricity, for one-third cubic foot of acetylene gas burned per hour gives more illumination than a 16 candle power incandescent light, or five cubic feet of ordinary gas. Allowing a maximum cost of $50 per ton for carbide, delivered either as a liquid or as carbide, 16 candle power with acetylene (one-third cubic foot per hour) costs $.0016; 16 candle power incandescent costs practically $.006; 16 candle power ordinary gas at $1.76 per 1,000 cubic feet with four foot tip, $.00704; or acetylene costs $\frac{1}{4}$ of a cent per hour as compared with electricity at $\frac{1}{2}$ of a cent, and ordinary gas at $\frac{7}{8}$ cent. These figures are based on the present method of manufacture and maximum cost, and no allowances are made for the improvements which must necessarily follow experimentation by practical men.

## Fatal Accident Accompanies Experiment with Acetylene.

Three lives were lost on January 21st, as the result of an explosion of acetylene gas, which wrecked the four-story brick block at New Haven, Conn., occupied by English & Mersick and Frank Pfleghar & Son, machinists. The killed were: Joseph C. Hauser, machinist, arm and leg blown off by the explosion and killed instantly; Harbona Stephens, a bookkeeper, found in the ruins after the flames had been extinguished, and Thomas Toof, body found in the ruins after the flames had been extinguished. The injured are: John Higgins, member of the fire department, injured by falling debris; Alexis Krah, foreman in factory, severely burned about the head and face; Lous Richter, burned about the head and face.

The explosion occurred in the tool room of Pfleghar's shop, which is on the third floor of the main building. Experiments were being made in the workings of machinery designed to control acetylene, and the gas was contained in two pipes four feet long and about six inches in diameter. The gas was so compressed in these cylinders that it was in liquid form.

In the tool room were Joseph C. Hauser, Frank Richter, Alexis Krah, the foreman; James McNeil, Louis Richter and Mr. Pfleghar and his two sons. They were all working about the engine, Hauser and Richter being right over it when the explosion occurred. Both were hurled to the ceiling, and Hauser's right arm and leg were blown off, killing him instantly. Richter was knocked unconscious and burned somewhat about the face and head, but otherwise was unhurt. All the other occupants of the room were knocked down, but recovered in time to escape. The total loss is estimated at $100,000.

## Acetylene Gas Discussed in Boston.

The monthly dinner of the Electric Potential club was held at the Quincy House, Boston, on January 21st. It was the best attended meeting thus far held, there being close upon 100 gentlemen present. The company included the leading electrical and gas engineers of New England, who had been invited to listen to an address on the new illuminant, acetylene gas, by W. R. Addicks, engineer to the Bay State Gas company, which has recently purchased the exclusive manufacturing rights from the Calcic Carbide company for Boston and Brookline for a large sum. Mr. Addicks gave a description of the properties of acetylene and of the development of the new industry. He said that there was a time when gas engineers did not take kindly to electricity, but to-day the two industries were almost identical. The gas men and electricians now meet on common ground, and acetylene gas has demonstrated that their interests are mutual. The paper was carefully discussed, and a vote of thanks was extended to the author.

## American Institute of Electrical Engineers.

At the meeting of the Institute held in New York on the evening of January 22d a paper was read by F. J. Sprague on "Electric Elevators, with Detailed Description of Special Types." About 150 members and guests were present. The paper was fully illustrated by lantern slides, and the practical operation of the electrical controlling apparatus was shown by a working exhibit of the essential parts on the platform. The paper was discussed by Messrs. Steinmetz, Hill and Leonard, but owing to the lateness of the hour further remarks were postponed until the next meeting.

At the meeting of council in the afternoon the following named associate members were elected: E. B. Cunningham, Fort Dodge, Iowa; C. L. Edgar, Boston, Mass.; Edward A. Evans, Quebec, Canada; W. S. Franklin, Ames, Iowa; Walter L. Githens, Chicago, Ill.; Zentaro Jijima, St. Louis, Mo.; Charles Lemon, Palmerston North, New Zealand; John E. Lloyd, Philadel-

been the target for all the usual criticisms, and such papers as the *New York Tribune* and the *Engineering and Mining Journal* in recent issues have asserted that there was never a ton produced in this country, and if there were it would have cost over $100 per ton. These statements can only be excused through a biased determination to oppose any new process, or a disinclination to investigate both sides of a question. That the new gas will be a rival to electricity cannot be denied, and as owners and managers of electric lighting plants it behooves the members of this association to investigate the subject for themselves and to decide as to its value as an opponent to not only the incandescent but the arc light, and not to take the advice of such electrical papers as are too cowardly to state the truth or too lazy to investigate. While at Spray every facility was given me to fully examine the plant and to make measurements of all factors entering into its manufacture. I regret that at this time I cannot make my report public, but I can state most emphatically that while I was there two tons of calcium carbide were produced in two days, and at a cost of about $25 per ton. Samples of this carbide produced an average of 5.13 cubic feet of acetylene gas per pound of carbide.

The methods used at Spray can be improved upon by anyone building a new plant, and many of the losses eliminated.

In regard to its use as an illuminant, acetylene gas when burned in a tip using one cubic foot per hour will produce about 50 candle power, but the flame, which is a solid flame, having no blue portion near the burner, seems to diffuse much more than this amount of light, because of the fact that its spectrum is nearly identical with that of the sun. A one-half cubic foot tip will give a flame that is ample for all purposes of house lighting, and these tips will be most generally used. Admitting mains through pressure reducing valves, it assumes all its gaseous qualities.

To sum up the situation from an electrical standpoint, this is a new gas having an illuminating power much greater than common gas. No investment for street mains is necessary, hence the gas companies must use it either as an enricher or as an adjunct to their present system to supply isolated buildings and residences which can be reached neither by their present mains nor by electric lights. If they obtain the rights for this gas, they will have a weapon which will be as much stronger than the Welsbach burners, as the acetylene flame is stronger than the Welsbach light. To produce this gas or calcium carbide, the gas companies must put in electric plants, which when not in use making carbide, can be placed in competition in electric lighting.

There are places, and many of them, where nothing will ever supersede the use of electric lights, but when you consider that only five per cent. of the residents of southern Wisconsin are reached by gas and only 30 per cent. are reached in Milwaukee, and that even less can be supplied with electric lights, there is a field opened which is wonderful in the possibilities for successful investments and large business.

Most of your lighting plants are idle during at least half the time, and could thus be made producing plants for the whole time, and you could reach a territory which cannot be reached by either the gas companies or yourselves without large outlays for extensions; and, in most cases, not reached at all.

Of the following facts I am certain: First, the gas is intensely brilliant; second, it has a decidedly disagreeable odor if it escapes without being burned, and when burned emits no odor or smoke; third, the gas can be distributed for much less cost (considering the interest on the investment) in cities, and also to every resident of the state, wherever in the city or country; fourth, the same amount of light can be produced for much less cost

1. Read before the Northwestern Electrical association, at Milwaukee, January 15-17, 1896.

phia, Pa.; Wm. E. Moore, Augusta, Ga.; Geo. P. Nichols, Chicago, Ill.; Wm. Bancroft Potter, Schenectady, N. Y.; Edward Andrews Wagner, Coahuila, Mexico.

The following named associate members were transferred to full membership: Harry Bottomley, Marlboro, Mass.; George W. Gardanier, New York, N. Y.; Fred A. Scheffler, New York, N. Y.; Harvey Stuart Chase, New York, N. Y.; Ralph D. Mershon, Pittsburg, Pa.; Norman T. Wilcox, Seneca Falls, N. Y.; Samuel Reber, U. S. Army, Washington, D. C.; Francis Jehl, New York, N. Y.

## Litigation Over Street Railway Tracks in Public Highways.

The Appellate Court of Cook county is considering the legal contention of the General Railway company of Chicago that it has a right to run its cars over the tracks of the Chicago City Railway company. Judge Tuley held in the lower court that the General Railway company could not make use of City Railway tracks in the disputed portion of East Twenty-second street without making just compensation therefor, and it is from this decision that the present appeal was taken.

In accordance with the Tuley decision the General Railway company also has pending two condemnation suits for the use of City Railroad tracks on Twenty-second and Clark streets, the compensation therefor to be fixed by a jury. It also has pending a suit at law for heavy damages growing out of the car-smashing episode of last April. The main contention of the McGann company, however, is that it should not even be required to make compensation for the use of City Railway tracks, claiming that the latter company has no exclusive ownership in the streets. The case was argued by counsel and a decision is expected by February 10th

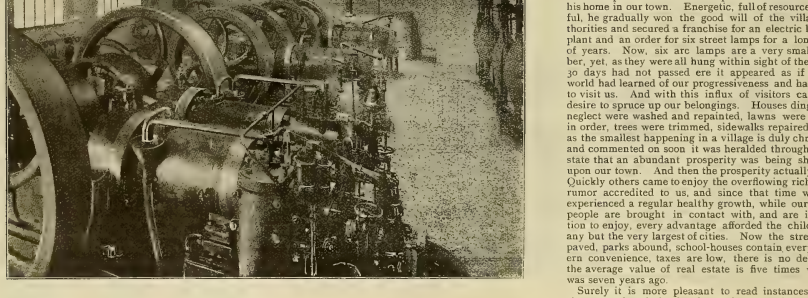


FIG 4 MUNICIPAL CASINO AT ROYAN.—ENGINE ROOM.

## Good Advice to Young Inventors.

In response to the query, "Do you think that as an electrician a young man of average ability has good prospects nowadays," the editor of the *Ladies' Home Journal* says: "A young man with a bent toward electricity unquestionably leans toward a science which has great probabilities within it. But it must not be forgotten that thousands of men are to-day working over the great electric problems. I remember very well a remark full of peculiar significance which a successful inventor recently made to me. He said that he was not reaching after the great inventions of the day, but trying to discover and create the little things which the vast majority of inventors, in their desire to invent the great things, overlooked. He does this to-day and is already a rich man. And for young men with creative genius there is much food for thought in my friend's remark. The smaller uses to which electricity can be put are more numerous than are the larger ones; fewer minds are at work upon them, and when discovered they are equally if not more valuable to the inventor

## The Upbuilding of the Small Town.[1]

By Fred DeLand.

Though we may not agree with the pessimistic side of the question Mr. Fletcher so ably presented in "The Doom of the Small Town," yet we must admit that he clearly pictured the silent tragedy that is being enacted in many towns and villages from which the young, the hopeful, the more ambitious depart to seek more suitable abiding places, leaving the dullard, the ne'er-do-well, the rich-in-purse-but-poverty-struck-in-soul to rust on in unhelpful existence. And while citing many causes that may have led to present conditions, his conclusion that "whatever be the causes, unless tendencies be arrested, the future of the small town is extremely discouraging, and it is very doubtful whether any material change in existing conditions will soon occur," is not nearly correct.

But the question I propounded to myself while reading this article was: Has Mr. Fletcher shown us only one side of the shield and that the dark side? Is it not possible to gather statistics relating to small towns that would have shown a condition of prosperity in many, even though such a showing would rob the first portion of his paper of much of its gloom? For there is nothing new in villages being deserted for towns more favorably located or offering greater advantages to the inhabitants. Such movements in our country can be traced as far back as the year 1700.

The reverse side of the shield shows that never before have so many small towns enjoyed modern improvements that not only tend to make life better worth the living, but also to increase property values out of all proportion to original investment. In the very states he mentions are towns of only 600, 800 and 1,000 inhabitants with electrically lighted streets, with well kept roadways and surrounded by that atmosphere of prosperity that attracts and invites the refined, the practical and the prosperous. In Michigan there are 71 incorporated cities varying in population from 237,837 (Detroit) to 746 (Gladwin), and in every city there is one or more electric lighting plants, which is not at all strange. But there are also 309 incorporated villages reporting a population in 1894 varying from 91 to 6,951. Of these 300 villages, nearly 100 have electrically lighted streets, though several reported a population considerably less than 1,000 souls. Compared with the census of 1890, the census of 1894 records a decrease in population in several towns and villages, but in no town of electrically lighted streets was any decrease reported, while the growth in some of these is almost marvelous. Speaking to a Michigan merchant on this subject, he replied that in his town of nearly 3,500 inhabitants the marked growth in population and in prosperity had its inception in the order of the village board directing that electric lights be employed in illuminating the streets at night. "Now the hanging of those big lamps in our streets has indirectly wrought as marvelous a change as often follows the placing of a new and attractive carpet in the reception room of the old homestead. Gradually the old style furniture is replaced by the modern and more attractive, until finally the room is modernized throughout, is artistic and comfortable. So it was in our town. The are lights gave us a taste of progressiveness, and awoke a desire for other improvements. Later the main streets were all paved with asphalt or with brick, and additional lamps were placed at street corners. Then some old frame stores that had been a fire menace for years were torn down and a modern office building erected on the site. These improvements furnished our local editor with a subject to talk about, and soon the fame of our house cleaning had penetrated every hamlet in the state. That this fame brought its own rewards is shown in the fact that we now have no less than seven factories, one of which employs 180 hands, and five large modern stores, to say nothing of numerous small shops, two new school houses, three churches, while 58 new dwellings and other buildings have been erected since the arc lamps were placed in circuit; and when I consider how remarkable are the changes that have been wrought, and how we might still be jogging along in the old way had the dozen oil lamps not been displaced by the big white lights, I feel very grateful for the wisdom and the forethought that ordered the expenditure that proved to be so profitable an outlay."

This is a homely illustration but thoroughly sensible and practical, and one that many a village resident might profitably ponder.

From another town comes this story: Our village was always blessed with natural advantages far superior to those possessed by neighboring towns, but we lacked that impulse so essential in starting any good movement. Following the building of a railroad through our town much business of a certain kind was transacted, but there was no healthy growth. The construction forces passed on, the undesirable characters that always flock along the line of a new railway flitted to greener pastures, and the town resumed its normal dullness. Thirty miles away a village having progressive merchants who tactfully sought the trade of outlying districts rapidly increased in population and in wealth; and there our own townspeople would go and make all but the smaller purchases. So our business houses decreased in number till we had but one dry goods store, a few shops, three groceries, a saloon or two and three churches, while the weather-stained fronts of buildings large and small told in plainer terms than any language could express that ours was a town of grayhaired toilers eking out only a semi-decent existence, and longing for the days to come when their children should be safely settled in one of the larger cities.

And then came the crisis. A shrewd old man of wide experience and broad views, searching for the right climate where his last days could be passed free from the pain and distress of a periodical ailment, made his home in our town. Energetic, full of resources, tactful, he gradually won the good will of the village authorities and secured a franchise for an electric lighting plant and an order for six street lamps for a long term of years. Now, six arc lamps are a very small number, yet, as they were all hung within sight of the depot, 30 days had not passed ere it appeared as if all the world had learned of our progressiveness and had come to visit us. And with this influx of visitors came the desire to spruce up our belongings. Houses dingy from neglect were washed and repainted, lawns were placed in order, trees were trimmed, sidewalks repaired. And as the smallest happening in a village is duly chronicled and commented on soon it was heralded throughout the state that an abundant prosperity was being showered upon our town. And then the prosperity actually came. Quickly others came to enjoy the overflowing riches that rumor accredited to us, and since that time we have experienced a regular healthy growth, while our young people are brought in contact with, and are in position to enjoy, every advantage afforded the children in any but the very largest of cities. Now the streets are paved, parks abound, school-houses contain every modern convenience, taxes are low, there is no debt, and the average value of real estate is five times what it was seven years ago.

Surely it is more pleasant to read instances of this character than it is the despondent conclusions Mr. Fletcher has presented in the *Forum*. And it requires no vivid stretch of the imagination to conclude that just as satisfactory experiences might have been recorded in some of the Massachusetts towns that report such a marked decrease in population during the last 10 years. The state census report just issued shows a loss in the 10 years intervening between 1885 and 1895 in 140 towns and villages. The streets of some of these villages and towns have never been lighted with electric lamps, and the decrease in population reported in each ranges from five per cent. to 25 per cent., while, on the contrary, many other villages have increased rapidly in population. Millis, for instance, from 683 to 1,006, or an increase of 47 per cent. from the day that modern progressive methods were introduced. Millis, it is needless to say, is a town of electrically lighted streets. Then there is Dudley, with a gain of 17 per cent. in population, and a dozen other electrically lighted villages, all showing marked gains, while their neighbors, puttering along with dark streets, have slowly degenerated.

1. Read at the annual meeting of the Northwestern Electrical association at Milwaukee, January 15 to 17, 1896.

## Electrical Apparatus for Mexico.

Senor Don Carlos Escovar is in Chicago to obtain material for electric lighting plants for the cities of Mazatlan and Culiacan, Mexico. These cities are about 100 miles apart, in the state of Sinaloa, on the west coast. They are from seven to eight days' journey from Chicago, and the freight will cost more than the machinery itself. Both plants will supply arc and incandescent lighting for municipal and commercial use. Stirling boilers, Ranken & Fritsch engines and Fort Wayne dynamos will be used. The alternating system will be employed for the incandescent lighting in both cities. Senor Escovar retained B. J. Arnold as consulting engineer

## Mayors Discuss Electricity in City Life.

About the first of the year the mayors of many American cities address the aldermen on the conditions and requirements of their respective municipalities. Electrical power, in all its varied applications, is now used so universally in cities, that many of the mayors' messages contain interesting references to it. As noted in the issue of this journal of January 18th, the mayor of Buffalo advocates the employment of a city electrician in that enterprising city. Other suggestions bearing on

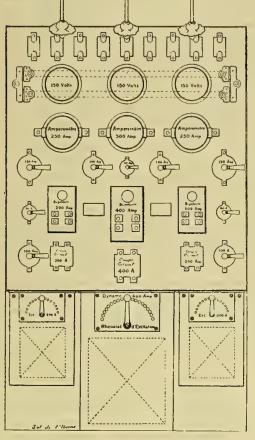


FIG. 5. MUNICIPAL CASINO AT ROYAN.—DYNAMO ARRANGEMENT.

electrical enterprises are made by municipal heads as follows:

*Utica, N. Y.:* I take pleasure in stating that a subway for telephone and telegraph wires has been placed in the business part of the city, and it is expected that early in the season our principal streets will be rid of that class of wires. It will then remain to devise some method of getting the electric light and other highly charged wires underground. I trust you will be able to successfully deal with this question, and thus remove from the streets the unsightly and dangerous obstructions which are caused by these wires.

*Worcester, Mass.:* It is the business of this [the wire] department to see that the wires for transmission of electric currents are safely put up and properly maintained. A beginning has been made in the removal of dead wires from the streets, and we look for a vigorous prosecution of this work during the coming year. The electric light and telephone companies, acting under decrees of the City Council, have already constructed a considerable amount of underground conduit, and there seems to be no reason why the number of overhead wires should not be materially lessened in the near future.

*Syracuse, N. Y.:* The city of Syracuse should own its own electric lighting plant. I have come to the conclusion, after some little study, that the municipality should own and control a lighting plant as well as a water plant. We must come to it sooner or later, and considering the subject now with a view to action at the first favorable opportunity. The amount of money that we are paying annually for lighting the streets of the city would more than pay the interest on a first-class lighting plant. Municipal ownership in lighting is practical, economical, necessary and in the interests of the people and not a favored few. The city of Detroit was offered $2,000,000 for her public lighting plant, which cost her but $600,000. Could we but keep politics out of this question and operate the plant on business principles and the merit system, the people would feel more like advocating municipal ownership of lighting.

*Springfield, Mass.:* In regard to municipal lighting, this year will witness a new departure in our street lighting department, the city having purchased the plant of the Chicopee Electric Light company at a cost of $27,000. A new station for the dynamos, engines, boilers and all the machinery connected with the system was ordered built on the lot near the high school. It was hoped to have the whole system under the control of the city by the first of this year, but on account of the failure of the contractor to have the buildings finished as agreed by the terms of the contract, arrangements have been made with the Chicopee Electric company to continue to furnish lights until the building is finished. In addition to the plant already in use, the incandescent system will be added, so that the city will be able to furnish lights for stores and private dwellings. We confidently hope that after the plant is in good working order, that the cost of lighting our streets and public buildings will be considerably reduced.

*Salem, Mass.:* Well lighted streets are second only to well cared for streets; the streets are rendered safer for travelers, and are of the greatest assistance to the police department. The freedom of our city from breaks and other offenses in the night time, I believe to be due, in a large measure, to their being so well lighted. We have the reputation of being a well lighted city; our citizens have become accustomed to well lighted streets, and would strongly object to a backward step in this direction. * * * * I believe in yearly contracts for street lighting, but it is a very bad policy to put off until very late in the year the making of these contracts. The contracts should be signed as early as the first week in September. Such contracts should include all lights in the city. At present, these corporations have an account against each department of the city.

*Fall River, Mass.:* The mayor advocated the giving of an opportunity for competition in the matter of electric lighting of the streets, and recommends that early in the year the question of new contracts be considered and determined. He does not think it advisable for the city to construct an electric light plant. It means a large expenditure, and the constant changes made necessary by improvements in electric equipment would call for continued expenditures, which will be much better provided for by private enterprise and capital for at least an additional five years. Underground wires are urged at the earliest moment.

*Holyoke, Mass.:* The five-year contract that the city had with the Holyoke Water Power company expired during last year, and a new contract for three years was entered into with the same company. Under this we pay $100 for each light per year, being a reduction of about $20 a year on the cost of each light under the former contract. Since the passage of the law authorizing cities and towns to provide their own electric lighting, the question of the desirability of doing so has been discussed. I am informed that one town in the state has availed itself of this provision of the law, and is supplying itself with electric lights at a lower cost than is charged by private corporations to other cities and towns. It might be well for our people to keep this matter in mind and to be prepared, upon the expiration of the present contract for electric lighting, to secure its electric lights on the most advantageous terms, whether by putting in its own plant or otherwise. We have now 237 electric lights, and 48 gas and naphtha. Since every additional light entails a cost of $100 upon the city, it is apparent that our present number should not be increased unless when absolutely necessary. It strikes me that instead of increasing the number, that some of the lights now quite numerous in some localities, might be, with profit, removed to places where there appears to be great need for them.

*Haverhill, Mass.:* On August 6th of the past year the City Council created an office, the duty of whose incumbent is to supervise and regulate all electric wires. I consider such action a step in the right direction. In this connection I would recommend to your careful consideration, the advisability of providing for the placing of many of the wires, running through the streets and over buildings, in suitable conduits under ground. The increasing tangle of these wires, and the unsightly poles and connections therewith, disfigure and mar the appearance of our streets and add greatly to the liability of accidents and fires.

*Omaha, Neb.:* Mr. Bemis, the retiring mayor, states that Omaha pays $120 per annum per arc, each lamp receiving a current of 9.6 amperes and 50 volts. In his closing report Mayor Bemis takes a stand in favor of municipal ownership of the lighting plant, basing his judgment upon facts and figures discussed in the magazines

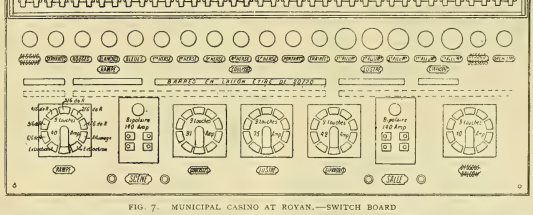


FIG. 7. MUNICIPAL CASINO AT ROYAN.—SWITCH BOARD

C. E. Speed of McGregor, Iowa, is an applicant for a franchise for electric lighting at Cresco, Iowa.

## Effect of Electric Motors and Bicycles on Horse Business.

So much has been said and written about the effect of the motor car and the bicycle upon the business of horse dealers, liverymen, etc., that the views of a man of experience in the horse business will not be untimely. F. J. Berry of Chicago says that neither electricity nor the bicycle can kill the trade. He continues: "It has been published in our newspapers throughout the country that electricity has knocked out the horse and made him cheap, and that electric and steam motors have taken the place of horses, and I have received a great many letters from all over this country for my opinion on this subject. I must say this is an erroneous idea. The country is growing, and the uses for which horses are required are multiplying. If is true electricity has taken the place of a great many street-car horses, but where it has shut off the demand in one place it has created a demand in others. For instance, every line of electric or cable cars or elevated roads for rapid transit has caused the people to build farther out from business

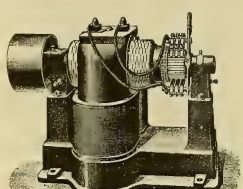


FIG. 6. MUNICIPAL CASINO AT ROYDAN.—TYPE OF DYNAMO USED.

centers, where they can keep and use horses that they would not, had they continued to live near the center of the cities. Then again, people living far out on the electric lines will go to the business portion of the city to buy goods, and these goods have to be delivered with horses, so, on the whole, the demand created by the rapid transit lines will very nearly offset the horses that are thrown out of use by electricity. As for electric and other motors that we have read so much about giving speed trials all over the country, and the prediction that they will take the place of horses for commercial purposes in our cities, I want to say to you that this can never be done, as steam or electric motors can never be used in our streets, as they would cause great destruction of human life, and the city authorities would never allow them to be used in the cities, so this is out of the question. Then comes the bicycle, which has worked some injury to our liveries, but horses that are used in liveries are but a drop in the bucket, and will never be missed from the trade. Bicycle riders are a class of people that could hardly afford the expense of a horse."

## Chicago Electrical Association.

The next meeting of the Chicago Electrical association will be held Friday evening, February 7th, at 1737 Monadnock building. A paper on "Lightning Arresters" will be read by W. R. Garton, and the discussion will be opened by G. W. Knox.

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WONDERS will never cease. Property owners on a Chicago thoroughfare have held a meeting and decided to begin proceedings against the Chicago City Railway company to compel that corporation to substitute for the present horse cars an overhead trolley system. It seems the company had made arrangements for the change, but there had been delays and the property owners became impatient.

RATHER unusual is the appearance of a tribute to the memory of an inventor in an official opinion by a judge of the United States Circuit Court, yet in the case in question it is safe to say that no one will take exception to the remarks of the learned jurist here quoted. In the following excerpt is summarized Judge Coxe's view of the value of the work of Charles J. Van Depoele in the development of the electric street railway: "Although the electric road of to-day is a composite organism to which many ingenious and able men have contributed, yet it may be declared that to Van Depoele more than to any other man, belongs the credit of having made it a practical, working success." The only regret is that the brilliant inventor did not live to enjoy the recognition which his work is receiving on every hand.

WHEN a man holding the position of president of the Metropolitan Street Railway company of New York publishes over his official signature a letter in which he suggests the "enactment of a law prohibiting the use of street railway tracks by other vehicles," it is not to be wondered that there are cranks whose chief occupation is to denounce corporations, and that the public, or a large portion of it at least, listens with approval to these tirades. We could leave Mr. Vreeland to the mercy of these professional reformers, were it not for the fact that others might suffer on account of his folly. Mr. Vreeland's friends, however, should see to it that his future contributions to newspaper literature are closely scanned by some person of common sense before they are given to the world.

REPUDIATED by the electrical fraternity and denounced by the merchants and taxpayers of the city, John P. Barrett has consoled himself with the reflection that he was still considered a man of importance by the political gang that infests the city hall, but even here he is not secure. The poor lighting service given in the city building has long been apparent, but up to the present time little has been said about it, as the occupants of the offices feared that complaints might offend the "professor." Now, however, that there is no longer any delusion about the "professor's" ability or his standing in the community, these long-suffering political hacks are complaining loudly about the insufficiency of the lighting furnished them, and their protests have been so vigorous and persistent that the commissioner of public works decided to make an investigation. This disclosed the fact, according to the *Chicago Tribune*, that there are not more than one-third enough lights in many of the larger offices, such as the Board of Election Commissioners, city clerk, water and special assessment bureaus, engineers' and the city attorney's quarters, to permit of work being done easily. The same paper says that much complaint has come from the clerks in these offices because of the effect upon their eyes. It is further announced that an appropriation of $10,000 will be asked by the commissioner with which to rearrange and enlarge the plant and rewire the building. In order to get relief, however, it will be necessary for the city to place the work in competent hands. Of course Barrett will want to spend the money appropriated, but if the city wants to get any returns it will have to secure the services of a competent engineer to plan and supervise the work.

VERY few men in this country feel that sense of security in their position among their professional brethren and before the community that will enable them to trifle with the newspapers of the country and through them impose upon the credulity of the public. Yet, this is the only reasonable explanation that can be offered for the recently published newspaper interviews with Edison upon the subject of electricity in warfare. The famous inventor has shown himself as ingenious in weaving a tale as in designing a mechanical device. He must have enjoyed himself hugely in contemplating the eagerness with which his words were caught up by the daily papers and spread broadcast over the land. Doubtless many persons were imposed upon, and it will be hard to convince them that they have been the victims of misplaced confidence. Lieut. Bradley A. Fiske, who is an authority upon the subject of electricity in naval warfare, points out that Edison's yarns may prove detrimental to the interests of the country. He says:

> It would manifestly be improper for me to say anything about the work which the government is doing, but something ought to be said to counteract the influence of what Mr. Edison said. Such things are liable to have a bad influence at Washington. Congressmen, for instance, might accept it all in good faith, and then when the departments came asking for an appropriation they would be met by the statement that there was no need of the work they were doing. If there should be war it would only be necessary to turn Edison loose and his schemes would suffice. But his schemes will not suffice. Two things were the trouble with the things Edison planned—those of them which contained elements of feasibility were old, and those which were new were, well, very new. The torpedo cable is years old. It has been worked at and worked out, and it won't do. There might be something in the aerial torpedo if he can control it. If he can, he can do more than any other man has yet accomplished. Maxim has worked at it a great deal, and so have the Frenchmen. The gun to shoot 20 miles and the electrified water are new, and he's entitled to all the glory he can get out of them, but it is doubtful if the gun would hit or the water kill.

Lieut. Fiske's criticism is just and deserved. He might have gone further and rebuked Edison for holding up to the ridicule of the world those admirers who faithfully accept his statements without reservation or restriction.

PERHAPS the most powerful weapon placed in the hands of the advocates of municipal control of commercial enterprises is the mismanagement of those corporations which give service, electrical or otherwise, to the general public. By mismanagement we mean that mistaken and short-sighted policy which is apparently based on the desire to "work" a municipal franchise for all the possible profit there is in it, to the disregard of the equities of the people granting the franchise. We believe that, in such lines as street railway service and street lighting, the people can be best served by the employment of private capital and the methods that are of approved success in supplying similar service in other lines of trade; but, where the original rights are obtained from the people by chartered companies, operating under municipal franchises, it is very obvious that the people, who are in this country always the ultimate source of power, have a right to demand efficient service at rates affording a reasonable—not an excessive—profit on the capital fairly and honorably engaged in the enterprise. A disregard of this equity is bound, sooner or later, to bring effectual rebuke to the corporation displaying it, and furnishes, as has been said, the most effective argument of those who would supplant individual enterprise in every direction by a general expansion of the responsibilities of the municipality on socialistic lines.

The general demand for three-cent fares in the cities of the eastern and central states shows that the public is awake to the fact that one of the beneficent results of the introduction of electric traction is a great decrease in the cost of operating street railways, and that it is determined to share in this benefit. This is a question which street railway managers must fairly and truthfully meet. While it is true that a sweeping reduction of 40 per cent. in the rate of fare would in many cases wipe out the profit altogether and work a grave injustice to the men who have made the investment, it is nevertheless evident that companies that are earning a net profit of from 15 to 18 per cent. on watered stock can easily afford to make a substantial reduction in price, of great benefit to the working classes, and still receive a handsome return on the money actually invested. There is no question that lower street car fares are bound to prevail, and the companies that meet the situation frankly and honestly, insisting on their rights, but also conceding to the public a participation in the benefits brought about by privileges obtained from it in conjunction with the general advancement of the art, will win the confidence of the people and receive the patronage and continued sanction on which they depend for existence.

It is not difficult to foretell what will happen to those corporations that fail to make reasonable concession to public opinion. Philadelphia furnishes two cases in point. The people there are incensed at the Union Traction company, owing to the interruption of service, due to the recent strike, the responsibility for which is generally laid on the company. What is the result? An ordinance has been introduced in the Common Council providing for the purchase by the city of the passenger railroad of the Frankford & Southwark Philadelphia City Street Railroad company. It is proposed that the city shall own the road and lease it for operation. The measure is stated to be "the wedge that will eventually split the arrogant Union Traction combination," and one daily paper makes this comment: "No corporation should be allowed to occupy public property and to utilize a franchise to the detriment of the masses. In this country the interests of the masses are supposed to be paramount to the interests of the few, and the time has come when the people must rule the railways, instead of allowing the railways to rule them." Turning to the field of street lighting, we see that in the same city great irritation has been caused by an increase in the price for public electric illumination. The city submitted to the terms of the one company occupying the field, but now there is a great cry for a municipal plant. "Next year a municipal electric light plant should be in operation," says the *Philadelphia Record*. "Then the city could snap its fingers at its defeated extortioners." The moral of all this is obvious. Patient and usually ill-represented in city government, the people still have rights and means for enforcing them. The wise corporations doing municipal service will recognize this fact and insure their own preservation by dealing justly with those on whom they depend for support

## Diplomatic Complications over the Trinidad Cable Station.

Interest in the diplomatic correspondence between Great Britain and Brazil over the occupation of the island of Trinidad is of special interest to the electrical fraternity, as the present complications grew out of the English policy to control the submarine cable service of the world. An explanation of the present situation is thus presented by a naval officer:

An English company holds an exclusive concession for coastwise cables in Brazil, the concession having about twenty years more to run. Sir John Pender, the cable king, several years ago determined to secure telegraphic connection between his great systems and the Pacific coast of South America, which is a lucrative field for telegraphic enterprise. To that end he entered into negotiations with all the South American countries for concessions, being successful in almost every country except in Brazil, where he was antagonized by the English company, which, under its exclusive right, operates all the lines from the Amazon to the Rio Plata.

He asked Brazil for the use of the island of Trinidad as an intermediate station, but the English company in Brazil opposed this, and defeated it through the very fact that Trinidad was Brazilian and therefore included in its own absolute concession. Sir John Pender went ahead, however, with his negotiations with other countries until a sufficient time had elapsed for an English war ship to go secretly to Trinidad and land there a number of Sir John Pender's employes. The English flag was raised, the cable company's operatives were left in possession, and the war ship steamed away again. The only inhabitants of Trinidad to-day are Sir John Pender's men taken there by the English government.

The concession secured from the Argentine government, which was especially favorable to that country, provided for the construction of a cable connecting with the company's main line on the African coast, and proceeding thence to Trinidad, the new port of La Plata, the Falkland Islands, and so around to Chili, the Argentine government giving the right only for the landing at La Plata.

On January 20th a dispatch from Rio de Janeiro contained the information that Dr. De Carvalho, Brazilian minister of foreign affairs, will demand from Great Britain the immediate restitution of the island of Trinidad, recently occupied by her for the alleged purpose of making it a landing station for a cable, but which Brazil claims as her territory. Another dispatch says that the British minister has handed to the Brazilian Foreign Office a note from Lord Salisbury in which are embodied the points held as the foundation for England's claim to the island of Trinidad. The British prime minister says that, while the English are in actual possession, in the exercise of a conciliatory spirit the government is willing to accept arbitration as a means of determining the rightful ownership. Brazil must reply definitely as to whether or not she will accept this friendly proposition at the end of the current month or on February 12th. The note further says that when the British Parliament opens the declaration that England now occupies Trinidad will be announced in the queen's speech, and that unless Brazil gives reason for delay in arbitrating the dispute, by showing better proofs of ownership than those already advanced, the island is lost to the republic.

Further interest was given the controversy by the announcement that the Argentine Republic had taken up the cause of Brazil and had given substantial proof of her sympathy for her sister republic by cancelling the English cable company's concessions. A dispatch from Buenos Ayres says: "The Argentine government has cancelled the concession granted to the English cable company to land at La Plata, on the ground that the company had failed to secure rightfully the other landing points necessary for its successful operation. This action, it is understood, is taken in concert with Brazil, and has direct bearing upon the Trinidad Island dispute."

Following closely upon this information came the announcement that the Brazilian corvette Benjamin Constant had sailed for Trinidad to take possession of that island. According to the dispatch the commander of the expedition was instructed to land a force if the island was deserted; otherwise, in the event of resistance being made to the landing, the commander was instructed to return to Rio Janeiro for further orders.

The Brazilian view of Great Britain's policy as explained by Minister Mendonca at Washington is that to expect them to arbitrate the ownership of Trinidad would be as reasonable as to ask the United States to arbitrate the possession of Block Island if England should suddenly occupy it on the ground that the United States had not hitherto made a good use of it; or, as another example, that the United States would tamely submit to England's establishing a colony on an uninhabited Florida key under the British flag because it was a desirable cable station and fit for nothing else.

## Electrolysis and Underground Cables.

An article upon the destruction of electric cables by electrolysis, which appeared in the *Pittsburg Leader* January 13th, has called forth most unfavorable comment by electrical experts, but reprints and extracts of the original article continue to appear in different parts of the country, and they give the public most erroneous impressions of the working of underground electric cables. An expert who has made this subject a special study says that while a number of gas and water pipes and cables have been destroyed by electrolytic action, it is also a fact that at the present time there are several well-known means by which destructive electrolytic action can be prevented. The cables in Pittsburg which suffered most from electrolysis were laid from six to ten years ago in wooden boxes filled with pitch, but the cables which have been laid in the ducts are giving perfect satisfaction, and electrical tests show that there is no immediate danger of their being destroyed by electrolytic action.

Since cables and water pipes began to be destroyed by the return currents of the electric railroads, much experimenting has been done by electrical experts to discover means to prevent the further destruction of underground pipes and cables. These early experiments prove conclusively that cables are only injured when the electric current flows from them to the earth through a moist medium, and that when the current goes from the earth to the cables there is no danger whatsoever of their being destroyed.

This investigation suggested at once the first remedy, which was to lay large copper wires parallel to the lead-covered cables and the electric railway, as a supplement to, and thoroughly connected with, the ordinary railway return system of rails and bond wire, and to connect the cables or water pipes by means of this supplementary return system, to the negative side of the dynamo of the electric railroad company, the positive side of the dynamo being connected to the trolley. This enlarged return system and the cables or water pipes connected thereto serve as a means of collecting the electric current from the rails of the electric railroad, and from the earth, and carrying it directly to the power house. This plan has been adopted in a number of places with most satisfactory results.

Another method, for which still better results are claimed, is to connect the negative side of one dynamo in the power house of the electric railroad to the cables, the negative side of the other dynamo being connected to the rails and return feeder, and the positive side of all the dynamos to the trolley. The voltage of the dynamo which is connected to the cables, is always kept from 10 to 20 volts higher than that of the other dynamos, and this, practically speaking, prevents any of the current from flowing from the cable to the earth, and thus positively makes electrolytic action impossible. Wherever there is electrolysis, there is loss of power to the electric railroad company. In one case, the amount lost in this way was 20 per cent. of the total power used for propelling the cars, as was proved by tests made before and after the method was adopted. From the standpoint of economy to the electric railroad company, the same good results are obtained when the first mentioned method is adopted; hence, everybody concerned is benefited by adopting these methods of preventing electrolytic action, and there is practically no danger of cables or water pipes being destroyed, when these means, so well known now to the electrical profession, are adopted.

## Baptism of Fire.

[From the *Electrical Age*.]

We wish to convey to our esteemed contemporary, the WESTERN ELECTRICIAN, our sympathy in its recent loss by fire of its composing material. With characteristic enterprise, however, a way was found out of the difficulty and the last week's issue was gotten out under enormous difficulties and very little behind time.

## Note the Difference.

[From the *Electrical Review*.]

Our tea-green contemporary is running a week behind in getting out, as it generally has been in the matter of news.

And now our chicory-tinted neighbor has been hypnotized or paralyzed by a miscalculated write-up, and has dropped behind a week. The editor who fails to look ahead a little, whether he intends to publish a big story or a lot of free advertisements, can only expect such disaster. These unnecessary delinquencies are in great contrast to our deep-blue contemporary at Chicago, which, although losing its printing office by fire, just as it was going to press, came out only a few hours late with a complete paper.

## A Lineman's Risks.

A somewhat novel, but still important, point is brought out in the decision of the Supreme Court of California, rendered November 30, 1895, in the case of Yearsley against the Sunset Telephone & Telegraph company (42 Pac Rep., 638). This was an action brought to recover damages for personal injuries sustained by the plaintiff while employed as a lineman by the defendant company. He had been ordered to string a line of wire upon certain telephone poles. A pepper tree, situated upon private land, and between two of these poles, was to some extent an obstruction in stringing the wire. Thereupon the lineman climbed the tree, and, while engaged in arranging the wire, the limb upon which he was standing gave way, and he was precipitated to the ground, with serious injury to himself. Under these circumstances, the court holds that a nonsuit was properly granted, because it fails to find any evidence of negligence upon the part of the defendant company. It cannot be claimed, says the court, that this pepper tree was an appliance furnished by defendant. It belonged to a stranger, and was upon private property. Even conceding it an appliance, and a defective one, it was one of the employe's own choosing, and he must bear the burdens resulting from a bad exercise of judgment upon his part. Suppose he had fallen from a defective fence encountered in the line of his duty while stringing this wire, and had suffered injuries, would the company be liable? Or assume that he had undertaken to swim a stream while in the line of his duty, and had been drowned, would there be a liability against his employer? The court fails to discover it. He was ordered to do certain work, namely, to string wires. He was furnished the poles upon which to string them. Without demanding further appliances of any kind, or informing his employer that others were needed, he proceeded with the work, and while so engaged, called to his aid additional appliances of his own selection. He stands in the same position as though he had chosen for his use a frail plank or a rickety ladder, rather than a pepper tree. For these reasons, the court holds that he was not entitled to recover. As to the comparative knowledge of the lineman and the company pertaining to the defects in the tree, and the dangers arising from its use as an appliance, the court did not deem it worth while to give consideration.

## A 1,500 Kilowatt Generator Burnout.

The *St. Louis Republic* gives the following graphic description of a recent burnout on one of the big direct-connected generators in the power house of the Union Depot Railroad company of that city:

Through the grounding or crossing of wires a short-circuit was formed on wires leading from the monster dynamo in operation, and in a twinkling it burst into dazzling blue flames that shot out a distance of 15 or 20 feet on either side of the machine and to the height of the ceiling above, while the huge flywheel, 25 feet in diameter, became a veritable fire wheel as it whizzed around through the flames at the rate of 75 revolutions to the minute. So brilliant was the spectacle, and so sudden and unexpected, that the attendants were for a moment dazed and blinded.

Assistant Engineer Hoffman and Electrician Pabish were fortunately standing far enough away to be out of harm, and as soon as they could recover from their surprise and realized what was the matter, they made a rush for the engine to shut off the power. This was a dangerous task, as they found, for the lever was within the circuit of the revolving electrical flames. But no time was to be lost; the floor and woodwork around the machine were now on fire, while the dynamo, under the intense heat, was sizzling, crackling and popping to pieces, emitting volumes of smoke from the burning rubber insulation of the wires.

At imminent risk of life Engineer Hoffman dashed into the flames and seizing the lever whirled it around to a shut-off position. By this time the room was full of pungent rubber smoke as to be nearly suffocating, but this did not deter Engineer Hoffman and his assistants from fighting against the progress of the flames. A water hose was brought into action, and in a few moments the fire was under control. Citizens opposite, who saw the brilliant illumination, equal to 1,000 arc lamps, thought the whole interior of the building, from floor to ceiling, was a roaring mass of flames and that the employes were perishing in the conflagration.

Great excitement prevailed, and an alarm of fire was turned in, but before the engine reached the scene the danger was over. The accident, of course, suspended all traffic on the road, but only for some 40 minutes, as a number of small dynamos were immediately harnessed on to the circuit and set going to supply the necessary power current.

The disabled dynamo is what is known as a 1,500 kilo-

watt generator of 2,000 horse power. It is one of the largest dynamos made, and the only one of the kind in the West, outside of Chicago. The machine and its twin engines cost $100,000, and it is estimated that it will cost $10,000 to repair the damage resulting from the accident

## Prof. Kennedy Recommends 230-volt Lamps for Edinburgh.

The Town Council of Edinburgh, Scotland, finds it necessary to extend its new electric lighting plant, and the electric lighting committee recommends the addition of four engine-dynamos for low tension and one high-tension unit, with the necessary boilers and auxiliary apparatus. This recommendation is based on an interesting report from Prof. A. B. W. Kennedy of London. Prof. Kennedy's report, showing the success of the Edinburgh plant and containing the suggestion that existing 115-volt lamps be replaced by 230-volt lamps, on the three-wire system, is worthy of attention on this side of the Atlantic. It is as follows:

The Edinburgh electric light station, as the committee will remember, was supplied with plant sufficient for the supply of electric energy to 40,000 lamps wired. This was the number given in my preliminary report as likely to be reached within two or three years for private consumers. I also gave, in my preliminary report an estimate of works costs as 3d. per unit (including all office expenses) when the output was 300,000 units per annum, and 2.5d. per unit when the output reached 680,000 units per annum. To a very great extent, in consequence (if I may be allowed to say so) of the energy and determination of the convener of the committee, the number of lamps wired already, after only 7½ months' working, is equivalent to 42,300 of eight candle power, besides arc lamps equivalent to about 3,316 more, making in all the equivalent of about 45,600 lamps of eight candle power already connected up, as compared with my suggested number of 40,000 after four times as long a period. I am glad to say that not only has the success of the light been almost phenomenal in the matter of the number of consumers, but under Mr. Monkhouse's management the economy of production has also been very remarkable. The total number of units actually sold up to date has been about 285,000 (in 34 weeks), and the total station expenses, including office charges, have been about £1,850, or an average of 1.56d. per unit sold, including units for public lamps, and including carbons and lamp trimming. This result for little more than a first half year's working, including all the summer months, when the demand is a minimum, and including also the actual start, when only 2,500 lamps were connected, is quite a record, so far as I know.

It is easy now to estimate the results up to the end of the year (37 weeks from the opening of the station), and they will be approximately as follows:

| | | | |
|---|---|---|---|
| Units sold, including arc lamps | | 384,000 | |
| Total income | £7,750 or | 4.85d. | per unit. |
| Station expenses | £2,200 | 1.37d | " " |
| Management and central expenses | 575 | 0.36d | " " |
| Total working costs | £2,775 | 1.73d. | " " |
| Interest and sinking fund at £7,670 per annum | 5,457 | 3.41d | " " |
| Total costs | £8,252 | 5.14d. | " " |

Thus it appears that in your first 37 weeks' working you will not only have paid all working expenses, but very nearly also all charges for interest and sinking fund, in spite of the fact that the period covered has been mainly summer time. In your first completed year of working (*i. e.*, by the middle of April next) you will have sold over 800,000 units, your total income will have been about £16,000, and you will have a credit balance of between £2,000 and £3,000, after paying every charge of which I have knowledge, including interest and sinking fund at the rate mentioned above. The total working costs will have fallen to about 1½d. per unit sold, averaged since the opening of the station. The total capital expenditure, so far as it concerns matters covered by my estimates, has worked out a little less than the estimates. As you are aware, however, considerable additions have been made to the work, both in the station building and in the mains, which have caused additional expenditure. The result seems to me to have been the best possible justification of the policy adopted by the Town Council in making these extensions. The amount taken for interest and sinking fund is the amount fixed by the town clerk, and corresponds, of course, to the actual expenditure, and not to any hypothetical amounts

I have thought it well to place these figures fully before you because there is no doubt that the question of extensions has at once to be faced From Mr Monkhouse's statements to me, and from my own observation of what has been going on in Edinburgh I can hardly doubt that you must be prepared to supply current to an additional 40,000 or 50,000 lamps (beyond those at present connected) by next winter, this number at least possibly more In my original scheme for the station I allowed for filling up the low tension side with units, each of 225 kilowatts or about 400 indicated horse power, similar to the two large ones which are at present in place I have gone into the whole question *de novo* with the benefit of Mr Monkhouse's experience in the actual running of the plant but have come finally to the conclusion that I cannot improve on my original plan, and should recommend that it be adhered to Under these circumstances the smallest addition which would meet the case would be two more machines, each of 225 kilowatts. These together could provide for 26,400 lamps alight at once, or say 53,000 lamps wired beyond those at present on the circuit. The station could therefore safely supply current for 90,000 to 95,000 lamps wired, including the equivalent of the arc lamps. This number will, no doubt, be reached by the end of 1896, and I think the only question now is whether you should put down four or six new sets at once. This plant would, of course, provide for all required extension of arc lamps so far as they lie on the route of continuous current mains. On the high-tension side of the station the addition of the 13 lamps from the postoffice to Regent Terrace (already sanctioned) will practically fully load the present rectifiers, leaving, of course, one spare machine. The proposed lamps on Clerk street and in Leith walk will be high-tension lamps, and if these are sanctioned two more rectifiers will be required, because half the lamps must be on an all-night circuit and the remainder on a half-night circuit. These two rectifiers will be sufficient for 25 or 30 additional lamps for still further extensions. Four rectifiers, when fully loaded, constitute very nearly full load for one of the existing alternators, and will, therefore, take up all the balance of power at present available for private high-tension lighting. For this purpose an additional machine will be required, and I think it ought to be of a capacity about double that of the present ones, or say 160 kilowatts. It would, therefore, be able to supply both private and public lighting during heavy load, leaving the existing machines to come on late at night, when the private load ceases. At the same time I believe it would conduce to economical working if a motor-alternator were provided which could be driven by the battery in the day time, so as to avoid the necessity of always keeping an engine (with boiler) actually at work.

As to buildings, nothing has been done in the engine rooms beyond finishing the concrete foundations for the new plant, as they were fully carried out in the first instance. The boiler house is also large enough for many more boilers than those mentioned below. But the space which must be occupied by the new boilers is used at present as coal store, and I think it would be desirable, when work is going on at any rate, to erect the gantry and finish the coal store above the boiler house, as I originally schemed it, and, as I believe, it is shown in Mr. Cooper's drawings. As to boilers, at present five out of the existing six boilers are used at full load, and the output at that time is more than can readily be done by four boilers, although the five boilers are by no means fully loaded. Four boilers more would therefore be sufficient to take up double the present output, but there would be a certain constructive convenience in adding five boilers rather than four, and I should advise that if possible this should be done. The present boilers and mechanical stokers have proved efficient and convenient, and I cannot suggest any improvement on the existing type except in such matters of detail as can easily be included in a revised specification. As to mains—the existing feeders, which contain, of course, the heaviest copper, have been laid large enough for about 75 per cent. beyond their present load, so far as they are laid in armored cable. Those portions of them which consist of bare strip can be nearly doubled in section without moving the roadway or pavement, and at a very moderate cost. This addition ought, no doubt, to be carried out during the open weather next spring. Existing distributing mains do not require any change. The extension of either feeders or distributing mains to new districts (such as Stockbridge, Lauriston or Dalry), is a matter to be considered and settled by the committee, but does not press just now so much as the extension of plant, as, of course, no new roadwork can be entered on until the spring.

There is another matter which I have to bring before the committee, and which is of very considerable importance—it is a matter on which some decision should certainly be arrived at reasonably soon; I mean the question of the use of lamps of doubled voltage. Two years ago, when I was asked to advise the Town Council on the matter of electric lighting, it had only just become possible to buy lamps having a voltage of as much as 115, and I advised the use of a three-wire system with this, the highest voltage then practicable. It was certain that later on lamps would be manufactured suitable for working at a much higher pressure, but how soon this would come about was only a matter of speculation. The system, however, which I recommended to you, and which you have carried out, was chosen so that full advantage could be taken of the new lamps whenever they came on the market They have come sooner than many of us expected, and are already to be had of satisfactory quality up to 200 and even 250 volts. I hope, therefore, that before long (that is, within the next two years or so) your system may be changed into a three-wire system at just double its present voltage, a change which will quadruple the present carrying capacity of the mains, and which will involve very little change in the station plant, engines and dynamos The capacity of the plant will not be increased, of course, but only that of the mains as well as the distance to which continuous current can be supplied economically from the station by the existing mains There are only two points of difficulty about the matter viz , the Board of Trade regulations and the disposal of the existing lamps As to the former, the matter has been referred by Sir Courtney Boyle to a small committee (consisting of Lord Kelvin, Mr Preece and Major Cardew) and their decision will very shortly be made public The question of existing lamps is a more formidable one After much consideration I have come to the conclusion that the following plan, or something like it should be adopted, and I hope to be able to carry it out even in Westminister, where we have about five times as many lamps to deal with as in Edinburgh. Let the undertakers give notice (*a*) that on and after a certain date (say 1st February, or perhaps May, 1896) their standard voltage will be 230 in respect to all consumers connected after that date; (*b*) that on and after another certain date, say 1st August, 1897, the new voltage will be standard over their whole system, new and old; and (*c*) that at any time between those dates the undertakers will supply any existing consumers with new lamps, for 230 volts, at the price of 6d. each, the old lamps becoming the property of the undertakers. The effect of this last clause would be that each consumer would run his existing set of lamps as long as possible, and then buy a new set very cheaply from the undertakers. The undertakers would probably lose about 8d. per lamp on the transaction. Your number of lamps, equivalent to 40,000 of eight candle power, probably means 20,000 actual different lamps, and thus the total cost to you of an operation which quadrupled the capacity of mains which may have cost you £50,000 or £60,000 would be about £670—plus the wages of men employed in changing the lamps, etc. There are no electrical difficulties in the way of making the change, and for your public low-tension arc lighting it would be an advantage—you would, in fact, get nine arcs worked for every eight which you now have without any additional cost. There are some difficulties in detail as to shops which at present use not more than two arcs, and as to a few motors, but these are small matters, which can be easily arranged, and it is unnecessary to encumber this report with purely technical details.

As to the cost of extensions, I stated to you in my report of 8th April, 1893, that the cost of doubling the capacity of your plant and feeders would not exceed £30,000. It is quite certain now that this figure will considerably more than cover the extension named, and will leave a substantial margin for extension of mains into districts not yet provided with electrical energy. One other matter I ought to mention—the question of the price per unit to be charged to consumers. Undoubtedly—as I have already pointed out in my early reports, and as is fully recognized by the committee—the way to make the electric light a success is to keep its price as low as possible. Although I am not to-day in a position to suggest a precise figure to you, I feel sure that you will be justified in making a substantial reduction either in the nominal price or in the scale of discounts, to take effect after the new year.

## Electricity in Gold Mining.

The system of Siemens & Halske for the recovery of gold from the tailings in mines has been in use in the Transvaal for some time, with good results. These tailings, says *L'Energie Electrique*, after all other processes of amalgamation, etc., still retain about 12 grammes of gold to the ton, and it was for recovering this metal that several processes were experimented with, the final selection of the Siemens & Halske process being indorsed as best, all things considered.

This process is based on the direct electrolysis of the cyanide of gold and potassium between two electrodes, one of lead the other of iron. The lead becomes the cathode, and is covered with a layer of gold, from which it is easily removed by smelting. The anode of iron is transformed into potassium ferro-cyanide and an oxide of iron, giving a precipitate of Prussian blue. The electromotive force necessary is only four volts, and with this voltage a ton of tailings may be completely cleaned up with an expense of 100 ampere-hours, or a total of four hectowatt-hours per ton.

The installation at the Worcester company's establishment comprised two troughs for receiving the tailings, measuring 6.08 meters by 2.32 meters, and five troughs for luxiviation of 6.08 meters diameter by 3.04 high; these would contain altogether 500 tons.

Each trough is filled and discharged daily. The precipitation is made in four tanks, 6.08 meters long, 2.128 wide and 1.21 deep. Copper wires on the rims of these carry the current to the electrodes, made up of 75 plates of iron for the positive and 74 plates of lead for the negative. The iron plates are 2.128 by 0.91 meters, and three millimeters in thickness. To prevent short-circuiting the troughs are covered with canvas. The lead plates are restrained from warping by being held between two iron wires fixed in light wooden frames, and are suspended between the iron elements. Covers with a lock and key are fitted to the tanks. They are opened but once a month for cleaning up. The electric energy required is furnished by a Siemens dynamo of eight volts and 600 amperes.

Electric energy has here found another source of employment, and by its aid about 10 per cent. of the mineral originally held in the rock, which has heretofore been lost, is recovered at a comparatively trifling expense

But this is not all; the writer says that an economical and thorough process of reclaiming the entire output of the mine has been devised and satisfactorily promoted in that country, so that eventually electricity may uproot and drive out all competitive methods of freeing the precious metal from the dross in which it is imbedded.

## Telegraphic.

Wallace—Do you think electricity will be much in use in the next war?

Ferry In the next war? Why, the Spaniards are winning most of their battles with it right now - *Cincinnati Enquirer*

At Houghton, Mich., the Peninsular Light & Power company is reconstructing its plant under the engineering advice of B J Arnold

## Ferranti Alternator of 1,000 Kilowatts.

The latest addition to the generating plant at the Deptford station of the London Electric Supply corporation is a 1,000 unit flywheel alternator, direct-coupled to a 1,500 horse power compound triple-crank steam engine. The alternator is by S. Z. de Ferranti & Co., and the steam engine or engines for there are really three engines on one crank shaft by Plenty & Sons. The London *Electrician* supplies the following particulars of this interesting and imposing piece of engineering, which, it says, reflects the highest credit upon all who have been concerned in its design and manufacture.

Nominally rated at 1,000 kilowatts, the alternator will usually develop 1100 amperes at 10,700 volts, allowing for the 700 volts drop in the transmission system; and it is capable of giving continuously a very much larger output if called upon to do so. The radial-field type, adopted by Mr. Ferranti in his Portsmouth alternators, has not here been followed, a return having been made to the parallel-field type of his earlier machines, on account of the higher frequency at Deptford. The armature coils, 64 in number, are mounted in pairs on ebonite-insulated spokes projecting from the rim of the flywheel. The coils are thus carried between two circles of field-magnet coils, 64 of these latter coils being placed on one side and an equal number on the other side, and all the field coils being mounted upon the inside of a cast-iron circular frame. The armature complete weighs 35 tons, and its extreme diameter is 22 feet; the diameter of the pitch circle of the coils is 20 feet. The speed at all loads is 136 revolutions per minute; and as this involves a linear velocity of 10,800 feet per minute, it will be seen that the centrifugal stresses against which the copper coils have had to be designed are something enormous. The armature coils are wound with hard drawn copper ribbon, ¾ inch wide, upon a core of laminated brass insulated with asbestos. The windings, both of the armature and of the field coils, are bare. The current density in the armature does not exceed 2,000 amperes per square inch at full load, and in the field coils it does not exceed half that figure. The field coils are wound on solid cores of hammered scrap wrought-iron, the cores being of circular section, five inches in diameter in the main part, and fitted with a pole-piece shaped in a rectangle with rounded ends, of nine inches diameter across the circular ends. Over the pole face a nine-inch circular cap of insulating material is securely fixed, the purpose of this being to prevent sparking from the armature to the field coils or cores. Some hard experience had to be gone through before the right sort of material for these caps could be found, as it is no easy matter to prevent sparking at 10,700 volts through a mere ⅛ inch or ⅜ inch of material. Woodite was tried, and while some caps of this material could stand over 20,000 volts, others broke down rapidly under normal pressure. The present caps are of enameled micanite, ⅜ inch in thickness. Into the gaps between the rectangular pole-piece and the circular cap, gun-metal filling pieces have been bolted. The clearance between any pole and the opposite pole on the other side of the armature is, when the machine is running, ¼ inch, and this is composed of ¾ inch for the armature, ⅜ inch for the two insulating micanite caps, and ½ inch for each air clearance between the armature and the pole caps. So narrow an air gap necessitates that the armature coils should be securely mounted, and that some means of adjustment should be provided for bringing them into exact center. These provisions are made in the following manner: Each pair of armature coils is first held in position in a frame and placed between two heavy bronze castings, with a sheet of mica between each casting and the metal of the coils. The castings are then hydraulically squeezed toward one another, so as to grip the coils tightly, and while in this position the castings are riveted together. The solidly built armature pair is now mounted upon a pair of radial pillars or spokes projecting outward from the rim of the flywheel. These pillars are arranged in pairs, side by side, and the bronze holding armature coils is bolted between the pillars in such a way that by the adjustment of a locked nut on the end of each pillar the coils may be shifted laterally and thereby be brought into exact center. The nuts on the pillars are ebonite-insulated.

The rim of the flywheel which carries the armature coils is in two parts, held together at the rim by two steel rings shrunk over lugs or bosses on the inner side. Each ring is 23 inches in diameter and five inches by three inches in cross-section, and is of Siemens-Martin forged steel. The rim is also held by eight double spokes of rectangular section and eight mild steel tie rods. These ties are of 5½ inches diameter in the body, and have six inch screws at their ends. At their inner ends they are secured to a mild steel block shrunk on to the armature spindle. This spindle is 18 inches in diameter in the main portion, coned to 12 inches in the bearings, and it is flange-coupled to the end of the engine shaft. The bearings are each three feet long, and are of the spherical pattern admired by Mr. Ferranti. A collar on the shaft outside each bearing serves to prevent end motion. We should mention that the frame of the field magnets is in two separate portions, one on each side of the armature, and that by means of an electrically driven worm gear these two halves may be drawn apart some 20 inches for cleaning or repairs.

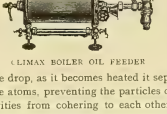
Several electrical and mechanical conditions have had to be complied with in the construction of this alternator. The rim of the flywheel has been made strong enough to hold itself together if it could be run up to speed without any other support than its own material and the rings at its joints; its arms are strong enough to hold the wheel intact, if it could be run with the rim fractured between each adjacent pair of arms; and the same strength has been given to the tie rods, they being strong enough to hold the rim should the arms be fractured. The chief electrical conditions were that the electrical efficiency of the alternator should not be less than 97 per cent.; that the current density in the armature and field coils should not exceed 2,000 and 1,000 amperes per square inch respectively; that the $C^2R$ loss in the armature should not be more than 0.8 per cent. of the output, and that the excitation should not be more than two per cent of the output. As a matter of fact, the excitation is well within the limit, being 400 amperes at 50 volts.

Turning now to the engine, it will be seen that it is in reality three separate tandem compound engines driving three cranks on the same shaft. The three sections of the crank shaft are interchangeable, as are all similar parts of all three engines, so that the breakdown of any one engine need not long stop the set, as the other two can be run by themselves, the only delay being that necessitated by the disconnection of the damaged engine or the interchange of a broken crank section and a good one. Each engine is built to develop 500 indicated horse power with steam at 140 pounds on the engine side of the stop valve and running at 136 revolutions per minute. The steam pressure at Deptford is often 180 pounds, so there is ample reserve of power, and it is estimated that 2,000 indicated horse power will be available from the three engines. The stroke is 26 inches and the diameters of the high and low pressure cylinders are 17½ inches and 36 inches respectively. The steam is distributed to the high-pressure cylinder by piston valves and to the low-pressure cylinder by a D slide valve, all these valves having the same travel and being carried by the same valve rod and eccentric gear. The weight of the valve gear is supported by the pressure of live steam on a piston in a small cylinder on the top of the valve chest, and in the down travel steam acts on the top of this piston. Variation of cut-off in both cylinders is effected by varying the travel of the valves, which in turn is controlled by Joy's hydraulic valve gear. The action of this expansion gear consists in hydraulically shifting the position of the eccentric with respect to the shaft, the throw of the eccentric being varied between zero or in center—when the cut-off would be close to the commencement of the stroke—and the full half travel, when the latest cut-off of about five-eighths stroke would take place. The eccentric is continually pressed in centerwards by means of steel springs, and outward by means of water pumped through a one-inch hole passing through the crank shaft. The hydraulic pressure, and therefore the position of the eccentric, is regulated by means of a small centrifugal governor.

Each engine is provided with a separate jet condenser and air pump. The condensers are formed inside the back cast-iron columns which support the engines; the air pumps are situated at the bases of the columns. Inside the condenser chamber the steam is in-drawn from the top and meets the injection water, which is sprayed upward from a nozzle at the bottom. Water from the adjacent Thames is used for injection; this water being forced into the condenser by the vacuum and without an injection pump. The tank is filled by the river every high tide and contains more than enough water to condense all the steam used in the station between tides. The suction from the air pumps is conveyed direct to the river, only a small portion being returned to the reservoir at times when the water in the latter is liable to freeze. Occasionally, however, the particular engine set under consideration is run non-condensing, when the pump rods are disconnected from the beams.

## Climax Boiler Oil Feeder.

The cut shows the device manufactured by Lovegrove & Co., 143 and 145 North Third street, Philadelphia, for feeding Climax boiler oil into the boiler, drop by drop, for the purpose of preventing scale formation. This oil has an affinity for the scale-producing matter held in suspense in the feed-water, and, being injected into the



CLIMAX BOILER OIL FEEDER

water by the drop, as it becomes heated it separates into innumerable atoms, preventing the particles of lime and other impurities from cohering to each other, and also prevents them from adhering to the tubes and shell of the boiler. The feeder is attached to the feed pipe with a three-quarter inch connection. The quantity of oil to be used will depend upon the quality of the water and amount of scale in the boiler. Experience has shown that, under ordinary conditions, one quart may be used to every 100 horse power per 10 hours' run. James W. Dailey, 319 Bourse building, Philadelphia, is the sole agent for this device.

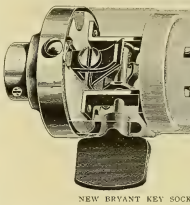
The sleet storm of January 22d interfered to some extent with the operation of Chicago electrical companies, but not to an extent comparable with the great storm of last November. The Chicago Telephone company's wires were damaged $1,000 worth

## Legal Rights of Repair Wagons.

Since the introduction of electric railways, the General Term of the City Court of Brooklyn says, we often see repair wagons with clanging bells and drawn by horses at full speed. But the court goes on to say that its attention has been called to no law which gives the repair wagon of a railway company a right of way over any other vehicle, or which authorizes the galloping of the horses attached to it through the streets, or which permits the clanging of the bell as a warning that vehicles or individuals should turn out. If the railway companies have no respect for the law, they cannot complain if they are held liable by juries for all damages which result from their negligence, and from its willful violation. The law requires that everyone who uses the streets shall do so carefully. The driver of a wagon used by a railroad company, the court holds, in the case of Northridge against Atlantic Avenue Railway company, decided December 23, 1895, has the same rights as the driver of a wagon used by an individual—no more and no less. And the rule that a person driving on a track of a street railway company is bound to look around occasionally, and see if a car is approaching has no application requiring him to watch for repair wagons.

## New Bryant Key Socket.

The Bryant Electric company of Bridgeport, Conn., has recently added to its line of sockets a key socket which is called No. 2 A. This socket, shown in the cut, with the company's No. 2 and No. 1 sockets, makes a very complete line of sockets. The peculiar feature of



NEW BRYANT KEY SOCKET

the No. 2 A socket consists of a change of shape of the elliptical cam fastened to the key. This is made of stamped brass and is secured by steel pins; it does not form a part of the conductor, however, having but the one function, that of making the contact. The socket in all its parts is of good material and is well put together.

Thomas G. Grier and Edward R. Grier, the managers of the western office, Monadnock building, Chicago, say that the sockets can be shipped the same day orders are received.

## Electricity in the Navy.

After a conference with the bureau chiefs of the Navy Department on January 22d, Secretary Herbert adopted the recommendation of the Bureau of Ordnance to install an electric turning gear in half the turrets of the cruiser Brooklyn and operate the remainder by steam. The speed with which the turret is turned is regulated by the variation of the current. There is a switch attachment by which the turret is stopped or reversed or moved quickly or slowly, as the operator desires. The chief objections to electrical turning gear for turrets are liability to get out of order and weight, which is said to be more than that of any other system. To offset these disadvantages it is claimed that in the case of the hydraulic motors used on the Maine and many other ships in the navy, the pipes are liable to burst by the freezing of the water in them. In Russia, many of whose ships contain hydraulic machinery for operating their turrets, steam pipes have been run alongside the hydraulic pipes, and the water is thus kept from freezing in them. Great Britain's battle ship Empress of India has also been fitted with this arrangement of the pipes. The Navy Department is considering the feasibility of making some such provision for the ships of our navy. The pneumatic system of turning turrets is also operating successfully abroad, and is expected to demonstrate its value when the monitor Terror's turrets are tested. The Navy Department intends to make an elaborate trial of the turning gear of this ship in order to compare the results obtained from the pneumatic system with those secured from other methods.

A bill has been introduced in the United States

Senate by Mr. Hill to authorize the construction of an electric cruiser, equipped with a system of electrical motors and propellers, invented by Richard B. Puinton, or the equipment of one of the present ships of the navy with that system. No definite appropriation is named in the bill. The inventor claims that a speed of 35 knots an hour can be maintained by cruisers thus equipped

## CORRESPONDENCE.

### New York Notes.

NEW YORK, January 27.—The stranding of the steamship St. Paul of the American trans-Atlantic line on the New Jersey coast at Long Branch has been the means of revealing the telephone in a new field of usefulness, and one which has excited great attention. The idea was simple enough—establishing telephonic communication between the stranded vessel and the nearest telephone line on the land, and thus with New York and other points on the coast—but it was, nevertheless, a happy and original thought, and was brought to a successful realization in spite of the obvious difficulties. The telephone line on the coast is that of the New York & New Jersey Telephone company. On the beach connection was made between the pole line and one end of a cable 700 feet long furnished by the Safety Insulated Wire company. This cable was attached to one of the life-savers' lines going out to the ship, and, with considerable difficulty, hauled on board. The cable was attached to one of the mastheads, over a pulley block, so that it would not snap with the motion of the ship, and the conductors were led down the mast and connected with an instrument in one of the officers' cabins. Thereafter conversation was easily maintained with the ship from Long Branch and also from New York and Philadelphia. An officer of the ship was especially detailed to answer the telephone, and verbal orders were given to the captain and ship's company from General Manager C. A. Griscom of the American Line, in New York. The improvised service proved very useful and was in great demand. This is believed to be the first instance of off-shore telephonic communication between a stranded vessel and the mainland.

The experiments with electrically operated cars on Brooklyn Bridge are now expected to take place the latter part of this week.

The annual report of the superintendent of public works has been transmitted to the Legislature, and as the subject of canal improvement is considered in this document, it attracted unusual attention. Concerning the application of electricity to the propulsion of canal boats, Superintendent Aldridge says:

Early in the season of 1895 application was made to me to officially designate a part of the Erie canal for the proposed test of the efficiency, economy and practicability of the so-called "Lamb system" for improving the present system of towage on the canals of this state. The location selected was a piece of canal about 1¼ miles in length at Tonawanda, N. Y. The purpose was to select such a portion of canal as would embrace as many practical obstacles to the success of such a plan of towing as could be found anywhere in a section of canal of that length.

On the 26th day of October, 1895, a test was made of the electrical appliances, previously erected and prepared, in the presence of ex-Governor Roswell P. Flower, the superintendent of public works, the state engineer and many prominent forwarders, boat-owners and other interested citizens, the department of public works being also represented by Charles R. Barnes, an electrical expert of Rochester, N. Y.

After the conclusion of the public test, many exhaustive private tests and experiments were made by Mr. Barnes, the results of which are fully detailed in the annexed report and tabular statements submitted by him.

The superintendent of public works is very sanguine that electrical canal boat propulsion is not only possible, but also that the devices which have been already tested and are being constantly improved, will result in a perfect system within the time required for the general improvement of the canals now inaugurated.

The test just made seems, in a general way, to be satisfactory, and to indicate that, as soon as the details of the system are so worked out as to meet every contingency of canal boat traction, it will become a cheap and handy means with boat owners and forwarders, and that canal traction will be largely reduced and the speed greatly increased.

Mr. Barnes' report, which was printed in the Western Electrician January 18th, is incorporated in Superintendent Aldridge's report. Another matter that will be of interest to electrical men is the following suggestion in Mr. Aldridge's report:

It is also recommended that an act be passed to the Legislature authorizing the superintendent of public works to contract with a telephone [illegible] at convenient points on superintendents' sections along the line of the canal, and making an appropriation therefor. A system can be so arranged that there will be a constant and automatic check upon each patrolman, and all necessary information be instantly transmitted to the section superintendent from any patrolman, locktender or repair scow. All of this, while being of the utmost importance, need not be enormously expensive. Permission may be obtained from the companies operating telegraph lines under permits from the state, along the lines of the various canals, to attach the necessary wires to their poles already or soon to be erected. For the purpose of commencing the inauguration of such a system, the appropriation of $50,000 is suggested.

W. F. O.

### Washington, D. C.

WASHINGTON, January 24.—A bill to incorporate the Columbia Telephone company has recently been introduced by Mr. McMillan in the Senate. John D. Langhorne, Benjamin Butterworth, John A. Baker, Tallmadge A. Lambert, T. Cushing Daniel, J. E. Keelyn, W. G. Waggaman and Thomas Armat form the body corporate, and desire the right to construct and maintain an underground electrical telephone system in the District, with the necessary conduits and ducts and mechanical and electrical devices and appliances pertaining thereto. The bill states that it shall be unlawful for the company to charge at any time more than $50 per annum for its service in any business establishment and $30 for any residence in the city of Washington.

The Washington & Great Falls Electric Railway company has transmitted to Congress its report for the year ended December 31, 1895. The receipts for the year were $77,090.83, as follows: From bonds, $75,600; passengers, $1,237.93; tickets, $250.50; sale of lumber, $2.40 The expenditures amounted to $76,770.48. The number of passengers carried from August 23d to the close of the year was 27,045.

The progress of work on the boulevard electric road between Washington and Baltimore justifies the expectation that parts of the line will be in operation by the first of June. The middle section, 13 miles long, form Loreley to Ellicott City, will be put under construction in April

The secretary of state has been appealed to by the Westinghouse Electric & Manufacturing company of Pittsburg, Pa., to assist in the search for Alexander J. Boroday, an American electrician, who is said to have been exiled to Siberia for alleged political offenses in Russia over six years ago. Mr. Boroday left this country last March and was provided with passports by the State Department. When last heard from he was at Kiev, his native place. In case it is found that Boroday has been arrested in violation of the treaty between the United States and Russia, a demand will be undoubtedly made for his release.

M.

### New England News.

BOSTON, January 25.—A bill is pending in the Massachusetts Legislature establishing a Board of Telephone and Telegraph Commissioners. Three commissioners and a clerk are proposed, the chairman to receive a salary of $3,000, the other commissioners $2,500, and the clerk $2,000. The expense of the board is to be assessed on the telegraph and telephone companies, but the commissioners are to be appointed by the governor. All companies must make annual reports to the board, which shall have general supervision over them, pass upon complaints and regulate the price and character of the service generally.

John W. Duxbury, a veteran in the telegraph business in the East, died at his home in Lowell on January 13th. He was general manager of the central division of the New England Telephone company, with headquarters in Lowell. For many years he was traffic chief in the office of the Western Union Telegraph company in Boston. Mr. Duxbury was born in Dover, N. H., in 1844, and was graduated from Bowdoin College in 1863. He immediately entered the employment of the Western Union, and was in charge of the telegraph for the Union army at Chattanooga

The advanced sheets of the report of Wire Commissioner Murphy, which is to be issued next month, give some idea of the vast amount of work which his department has accomplished during 1895. Many thoroughfares in the business section are now clear of overhead wires and poles, making it a pleasure to pass through them. The New England Telephone & Telegraph company has removed some 4,000,000 feet, including cables, while the Boston Electric Light company is removing its wires at the rate of 10 miles or more per day. The Western Union Telegraph company has removed all of its wires from poles and most of them from buildings, and the same can be said of the police and fire departments. The quantity of duct laid and cable drawn in during 1895 by all users of electric wires has been tabulated by Commissioner Murphy for his annual report, as follows:

| | Feet of duct laid. | Feet of cable drawn. |
|---|---|---|
| West End Street Railway company | 43,000 | 58,000 |
| Boston Electric Light company | 300,000 | 576,000 |
| Smaller companies | 50,000 | 15,800 |
| Fire Department | 2,500 | 24,000 |
| Police Department | 30,000 | 60,000 |
| Edison Electric Illuminating company | 35,000 | 35,000 |
| New England Telephone & Telegraph company | 78,000 | 119,000 |
| Church-Green Electric Light & Power company | 1,000 | ..... |
| Western Union Telegraph company | 4,000 | 6,000 |
| Postal Telegraph-cable company | 8,000 | ..... |
| Boston District Messenger company | 600 | ..... |
| Miscellaneous | 5,000 | 5,000 |

The amount of wire overhead in the 1895 district, for which underground accommodations were provided, was in the neighborhood of 11,000,000 feet. The work done from January 1, 1895, to January 1, 1896, in the way of laying underground ducts for the accommodation of wires, drawing in cable, etc., was considered extraordinary, in view of the fact that it was carried on in the congested part of the city. About 554,400 feet of pipe was laid and 898,800 feet of cable drawn in. This left about 1,000 feet of pipe laying and 131,200 feet of cable drawing undone, the former consisting of some service connections belonging principally to the Boston Electric Light company, and the latter being divided up between the Boston Electric Light company, 69,000 feet; Postal Telegraph-cable company, 10,000 feet; Western Union Telegraph company, 4,000 feet; Church-Green Electric Light & Power company, 5,000 feet; and smaller companies (some nine in number), 43,200 feet. The companies, however, have made such good progress that, except as regards dead wires, the wire department has not been compelled to remove any of their wires, as required in case any remain overhead after January 1st. In the 1896 section are about 1,500 fixtures and outriggers, and about 15,000,000 feet of overhead wire, mostly over buildings. A large amount of this wire has been removed already by the wire department and the owners, and considerable of the underground work necessary this year was anticipated during 1895. Such companies as the Western Union Telegraph company, Postal Telegraph-cable company and the Boston Electric Light company have completed work sufficient, with a little additional labor in the way of connections, to enable them to look after the wires in the section running down to Hanover street that will claim attention this year. This section contains about one-fourth of the entire territory affected by the act of 1894.

The gas and electric light commissioners issued an order January 14th approving an issue by the Boston Electric Light company of $200,000 mortgage bonds, 30 years, not exceeding five per cent., said bonds and the proceeds to be applied in payment of the cost of additions and extensions of the company's plant made since July 1, 1895, "or which may be made subsequent to that date." The report says: "From an examination and appraisal of the company's property, it appears that the fair structural value of the plant at the time of the application of the company equaled the outstanding bonds From the testimony and schedules submitted at the hearing it appears that the proposed extensions and additions are needed to meet the public demands, and will require the amount stated in the petition." The company asked for $250,000, stock and bonds, $200,000 to be applied to the cost of extensions and additions to the company's plant subsequent to the date of the petition, and $50,000 to funding a portion of the floating debt then existing. The board is satisfied, however, that the income of the company is ample to permit it to adopt the policy of paying its debts rather than of funding them as a permanent burden. In view of all the facts the board is able to approve of bonds to meet the cost of new extensions, but not those intended for the funding of the debt.

C. S. G.

### Northwestern Notations.

MINNEAPOLIS, January 24.—The contract which the City Council of Davenport, Iowa, offered to the People's Light company, to include the establishment of a heating and gas plant, was refused, and the contract then awarded to Walsh Bros. of Clinton, Iowa.

The city of Butte, Mont., will vote at the next election on the establishment of a municipal electric plant. The present contract for light does not expire until 1898

Newell McGeorge has petitioned the Fort Pierre, S. D., council for a franchise for an electric line to connect with Pierre.

The city of Mankato, Minn., is taking bids for the establishment and operation of an electric light and power plant, and an electric street car system with five miles of line.

The receiver for the General Electric company of Winona, Minn., has been ordered to put vestibules on the street cars there. These are said to be the only electric cars in Minnesota not vestibuled.

The people of Farmington, Minn., are considering an electric light plant. C.

## PERSONAL.

Luther Stieringer, the consulting electrical engineer of the Atlanta exposition, which came to an end a month ago, spent Monday and Tuesday of this week in Chicago. He was warmly welcomed by many old friends.

President A. A. Ziegler of the Ziegler Electric company of Boston, Mass., has been confined to the house for the past three weeks because of the burning of a Christmas tree at his home. In throwing the tree out of the house, Mr. Ziegler's hands were severely burned, but the attending physician now says that he will not lose the use of them. It was a narrow escape from a permanent injury.

President Piiny Jewell of the Jewell Belting company of Hartford, Conn., and president of the Leather Belting Manufacturers' association, was in Chicago last week as a delegate to the manufacturers' convention. Mr. Jewell was pressed by leading delegates to accept the office of president of the association, but his numerous connections in business circles would not permit of it, much to the regret of his friends. General Sales Agent C. L. Tolles of the Jewell Belting company was with Mr. Jewell at this meeting.

General Manager W. Boardman Tobey of the S. K. C. Specialty company of Pittsfield, Mass., has resigned to accept a flattering offer made by the Ecuador General Electric company of Guayaquil, Ecuador, to take the general management of its business. Mr. Tobey has many acquaintances in the electrical trade who will wish that only the best success attend his new business relations. That the concern to which Mr. Tobey goes has secured one of the growing men of the business is attested by the high positions he has held in several electrical companies.

George Barnett, the president of the G. & H. Barnett company, Philadelphia, Pa., manufacturers of the well-known Black Diamond files, died at his home in Germantown, Philadelphia, on January 7th, after an illness extending over a long period. Mr. Barnett was 63 years of age; he was a native of England, but he learned his trade as a filemaker as a boy in Philadelphia. With his brother Henry he built up a very successful business, and the concern now employs 500 hands and sends its products all over this country and Canada and to many European countries. For years Mr. Barnett had enjoyed the reputation of being one of the best practical filemakers in the country.

## ELECTRIC LIGHTING.

The electric light plant at Cardington, Ohio, a few miles north of Delaware, burned to the ground recently. A live coal fell on the floor, which was saturated with oil. The loss is $9,000.

The electric light plant at Aberdeen, S. D., has been sold to J. S. Batcholmew of Grand Forks, owner of the local gas plant as well. The facilities will be greatly improved and additions made to the buildings. The consideration was $6,000.

The Springfield Electric Light & Power company of Springfield, Ohio, is rebuilding its station plant. New Corliss engines and additional arc and incandescent machinery is being placed at an expense of $25,000. B. J. Arnold of Chicago is the consulting engineer.

The city of Columbus, Miss., has decided to have the streets lighted by electricity, and has accepted a proposition of the Brush Electric Light company of Savannah, Ga., to put in 40 arc lights and have them ready by April 1st, when the present contract with the gas company will expire.

Negotiations have been pending for several weeks between the Hartford Electric Light company (capital $350,000) and the Hartford Light & Power company (capital $150,000), the two electric light companies of Hartford, Conn., for consolidation. It is now stated that the arrangements have been completed by which the former company absorbs the latter.

The Edison Illuminating company of Detroit is preparing to erect a plant on the east side of the city to take care of the increasing commercial business in that section of the city. President George Peck of the company says that the plant will be very complete in every respect. No site has yet been selected or plant prepared. The plant, it is stated, will not be built, if at all, before next summer,

The controlling interest in the Syracuse, N. Y., Electric Light & Power company has been purchased by the Boston bondholders of the company. The amount of stock purchased from the Syracuse stockholders is said to be about $400,000. The price paid for the stock is reported to be 30. The negotiations were conducted by George W. Davenport, acting for the Union Electric Security company and the Street Railway & Illuminating company of Boston.

## ELECTRIC RAILWAYS.

It is said that the accident list of the Chicago City Railway company has been reduced one-quarter since the new law for stopping street cars on the near side of crossings has been in effect.

The Bath, N. Y., & Keuka Railroad company has made application for a franchise to the trustees of the village of Hammondsport to operate a trolley system in that town. It is said the village officers are in favor of the scheme. If a right of way is obtained there, the company proposes to begin construction immediately.

It is reported that the construction of the new electric line from Watch Hill to Narragansett Pier, R. I., via Point Judith, will begin during next month. The road will be 30 miles long, and will follow the sea beach the entire distance. It will open up for seashore purposes one of the finest beaches between New York and Boston.

It is stated that the Philadelphia syndicate which sold the Meriden, Conn., electric railway to the Consolidated road made a profit of $197,000 on the transaction. The electric company sold 9,850 shares at $20 per share to the road. The Consolidated road also assumed a floating debt of $70,000 and purchased a first mortgage of $101,000, making the entire expenditure, in order to get hold of the property, $368,000.

All probability of another strike of the motormen and conductors of the Union Traction company is now believed to have ended. The directors of the company ratified the recommendations that were submitted to both the company and the employes by the citizens' committee, and a committee of the employes called on John Sparhawk, Jr., a member of the citizens' committee, and announced agreement with the terms proposed.

Electric railroads are proving of great benefit to the farmers in Maine. The trolley lines run out from the large cities and towns to villages far removed from steam railroad communication, and in several districts arrangements are making to run trolley milk trains, vegetable trains, and the like, to enable the farmers to get their produce quickly to market. It is even proposed to run trolley coal trains to supply coal to small towns that now use only wood.

The Title Guarantee & Trust company has been discharged as receiver of the West End Street Railway company of Rockford, Ill., and the property has been turned over to the new owner, the Rockford Traction company, of which John Farson of Chicago is president. The people of Rockford are much pleased to note the change in management, as it is understood it is the intention of the present owners to give the citizens the best street railway service they have ever had.

At the annual meeting of the stockholders of the Rochester Railway company the following named directors were elected: H. Sellers McKee, Horace Magee, Richard W. Gill, Thomas Dewitt Cuyler, Benjamin Graham, John N. Beckley, Frederick Cook, Marsenus H. Briggs, George W. Archer, Jacob Gerling, A. Erickson Perkins, E. M. Upton and F. F Allen. The directors unanimously re-elected these officers: President, John N. Beckley; vice-president, Benjamin Graham; secretary, Charles A. Williams; treasurer, Frederick F. Allen; general manager, F. O. Rusling; inspectors, C. A. Williams, A. Masters McDonnell.

## TELEPHONE.

The Northwestern Telephone Exchange company has perfected plans to extend its long-distance lines from Fargo to Lisbon, N. D., and has secured the right of way.

A receiver has been appointed by the District Court of Topeka, Kas., for the Topeka Telephone & Electrical company. The receivership was asked by the City Real Estate Trust company on a claim of $11,000 with interest from May 1, 1895. Charles B. Knowles was appointed receiver by the district judge. The real estate company is trustee for $15,000 worth of bonds issued by the original company. Of these $5,000 were bought by Edward A. Rozier of St. Louis, and afterward $6,000 more were sold to him, with the remaining $4,000 held as collateral security. This makes the amount of the bonds held by Rozier $11,000, for which the real estate company is trustee. The step is regarded by the members of the company as friendly to that of the company over until claims they say are unjust can be settled. They regard it as the best thing for the creditors and the company.

The Colorado Automatic Telephone company, located at Colorado Springs, has just secured a franchise for telephone purposes in that city. Six telephones are to be furnished to the city and as many more at half rates as may be required by the City Council. The company has 30 days in which to accept the resolution and nine months in which to complete the exchange. It will not put wires in conduits until all companies are compelled to do so by the City Council. The life of the resolution is 20 years. The rates are to be $30 for residences and $40 for places of business; long-distance metallic circuit instruments being used in connection with automatic exchange switches. The construction will commence immediately. The completed exchange will start, it is said, with about 500 subscribers, double the number now using Bell instruments. Nearly that many three-year contracts have already been secured. The company's president, James F. Burns, and three of its directors own a controlling interest in the famous Portland gold mine, said to be the largest producing mining property in all Cripple Creek.

## MISCELLANEOUS.

Report of a curious accident comes from George Vanderbilt's country place at Asheville, N. C. Henry Fontet, an electrician, went into the gasoline tank to make an examination. He was missed and William Lawrence went in search of him. Lawrence was overcome and almost suffocated before taken out. Fontet's dead body was recovered after it had been in the tank several hours. He was a native of Switzerland and leaves a widow.

There was a strike in the Westinghouse Electric & Manufacturing company's factory at East Pittsburg last week. The contest was between the company and a portion of its employes over a cut in the punching department amounting to from 10 to 20 per cent. These employes are paid by the piece. The company claims that the improved machinery introduced in this department will enable the punchers to average the same pay as heretofore. The management did not hold the positions of the punchers open as in the winding department, where girls are employed, but filled the places of a number of the strikers with new men.

A meeting of the supporters of the scheme to organize a technical club in Chicago was held in the rooms of the Western Society of Engineers on January 24th. About 75 persons were present, and all the preliminary steps were taken toward effecting the organization. The purpose of the promoters of the idea is to create a club constituted of engineers, architects, contractors and those identified with the scientific branches of manufacturing. The meeting was presided over by Captain Robert W. Hunt, and Hugh M. Wilson was elected to the office of secretary. Committees on organization and location of quarters were appointed, the former consisting of C. E. Billin, J. W. Cloud and George W. Lederle, and the latter of A. Sorge, Jr., H. F. J. Porter and J. F. Lewis.

A leading Boston financial journal of recent date says: "We understand that the General Electric company has been devoting attention of late to the matter of improving its facilities for turning out work cheaply. Its apparatus has become established to such an extent that it is now less a question of how parts shall be made than how they can be made to best advantage. Experts have been examining different processes with the result in many cases of simplifying methods maierially. In one case, a method by which machinery in use produced parts at the rate of only one in five or six minutes, gave place to one by which they could be produced automatically at the rate of 100 a minute. This principle applied to the various departments is expected to effect quite a material saving in operating cost."

A movement is in progress for the establishment in New Bedford, Mass., of a factory for the production of electric dynamos, motors, switches and switchboards, rail bonds, and other street railway supplies. The company which is being formed is to have a capital stock of $70,000, of which $50,000 has already been secured. Among the subscribers to the stock are George K. Stetson, Rufus A. Soule, N. B. Kerr, Abbott B. Smith, Rodolphus Beetle and Anthony L. Sylvia. Mr. Stetson says that with a capital of from $60,000 to $70,000 the business can be run successfully, and bring to New Bedford an enterprise which inside of two years should employ 100 first-class mechanics. Charles S. Mendell, who has for the last three years been connected with the Union Street Railway company as electrician, will be general manager of the new company. Mr. Mendell has been engaged in the manufacture of electrical appliances for 13 years.

## TRADE NEWS.

Alfred Moore of Philadelphia says that his business has kept up its usual average, and that the works are at present crowded with orders, but this seems to be the general condition with Mr. Moore's business.

J. F. Chase & Co., engine builders of Mattoon, Ill., manage to keep busy. They are now erecting their ninth engine for the St. Louis Brewing association and have recently placed several others. Their engine has recently been improved by a change in design.

The Electric Protection company of 1026 Filbert street, Philadelphia, reports that the sales for the Stevens flush switch have increased largely during the last few weeks. Those who have had these switches in practical operation during the last year testify that they are, as claimed, "moisture-proof," and the mechanical construction has given no trouble.

C. E. Ainsworth, New York agent of the Jewell Belting company, has taken office room at 105 Havemeyer building. He reports that his sales for this company were in 1895 double that of any previous year in his territory, and that the present indications are for an even larger increase in his business. The Jewell belts are well known among the central station and power plants throughout the country.

A. J. Burns of Kansas City, well-known as an electrical expert, has decided, after one year's test on different plants all over the state, to take the agency of the Boudreaux dynamo brush for Kansas City and Missouri. This is a new victory for the Boudreaux dynamo brush, which has been re-christened by the engineers the

"new principle brush," as a concession to those who find it difficult to wrestle with the French name.

MacCurdy & Smith of Indianapolis are doing a good business in construction and supplies in that thriving city. They have recently secured the contract for wiring the fine building of the Natural Gas company, using iron armored conduit and carefully complying with the rules of the National Board of Fire Underwriters. Many old buildings in Indianapolis are being rewired in accordance with the requirements of the underwriters.

Barton L. Peck of 32 Clifford street, Detroit, is exploiting the Ebonite commutator dressing. This is a solid lubricant which is being extensively used on commutators supplied with both copper and carbon brushes. When properly applied it is claimed to prevent sparking and cutting. It may be safely used on dynamos generating high potentials, as no shock can be received through it. It is made up of compounds free from acids or other destructive substances.

The large sale of Medbery station switches indicates that the trade appreciates high grade material. The pony switch made by this company has already become a standard article for the purpose. It is made with the same regard for accuracy as that given to the larger sizes; in fact, it is claimed that it is the only absolutely reliable pony switch manufactured. The selling agent, the Mason Electric Equipment company, Chicago, has placed these switches with the leading supply houses, which are selling large quantities.

Among recent shipments of its new alternating current power motors the Emerson Electric Manufacturing company of St. Louis reports two ½ horse power and one 1 horse power machines to New York; one ½ horse power to Buffalo and one ½ horse power to Memphis. The company expects to be obliged to increase its capacity in this line very shortly, as the demand for this motor is from all parts of the country. One of the most gratifytng features is the confidence which the trade seems to place in this new motor, merely because it bears the name and guarantee of the Emerson company.

The manufacturers of the Packard lamp recently received from one of their customers an interesting souvenir in the shape of an old burned-out Packard lamp, together with a valentine card on which was written: "This lamp has been in constant use for two years and three months." Accompanying the valentine was a congratulatory note from Mr. Hesser of the Cincinnati Gas Light & Coke company. The Electric Appliance company has had the souvenir on exhibition at 242 Madison street, Chicago, where it has attracted considerable attention. A lamp which has burned over 19,000 hours is certainly entitled to more than ordinary respect.

The Garlock Packing company of Palmyra, N. Y., with branch offices in New York, Boston, Chicago, Philadelphia, Pittsburg, Omaha, St. Paul and Rome, Ga., reports that its business for the year 1895 was the most prosperous in the history of the company. The sectional ring, elastic ring, spiral and special water packings are not only holding their own, but are becoming more popular year after year and are coming into general favor with engineers of all sections of the country. The new waterproof hydraulic packing is especially adapted for high pressure pumps, hydraulic machines and pumping stations. The company has recently placed in the market a high pressure packing intended for high pressure work on locomotive, stationary and marine engines, which is designed and made to insure long service.

## BUSINESS.

The Hart & Hegeman Manufacturing company of Hartford, Conn., has brought suit in the United States Court against the Anchor Electric company for alleged infringement of patent of the Hart snap switch.

The Whittingham Electric Car Heating company of Baltimore reports recent sales to a number of roads. The general superintendent of the Ithaca, N. Y., road considers the Whittingham heater the best on the market.

A. O. Schoonmaker, 158 William street, New York, is now prepared to furnish mica disks and washers stamped out of India or amber mica. Those desiring any form of mica will do well to write to Mr. Schoonmaker for information.

The Eddy Electric Manufacturing company of Windsor, Conn., reports the largest force of hands since it has been in business. A large amount of work is on hand for future delivery. This will keep several departments at work overtime in order to fill orders promptly.

General Manager M. M. Whipple, of the American Machine & Tool company of Boston, Mass., reports that the results of the year 1895 in his business far exceeded the anticipations. The outlook is for an increase and the company hopes to extend its business to many points in the West and South.

General Manager J. O. Davis, of Davis & Son of Hartford, Conn., who manufacture the original Berryman heater, reports that the business for the past year has been a large one for them, and much in excess of 1894, with prospects of still greater extension this year. The productions of this firm are to be found in many of the leading electric power stations of the country, and the Berryman heater is recognized as having but few equals.

The western office of the Bryant Electric company (Thomas G. Grier and Edward R. Grier managers) is notifying the trade that the genuine K. W. cut-outs are packed in individual boxes with the Bryant Electric company's name on every box, and can be obtained from all dealers when specified. This company is developing some new and advanced specialties for high-tension work. W. C. Bryant, the general manager, in his earlier days was the electrician and superintendent for a central station, and he fully appreciates the value of keeping up to date on all devices. The new productions of his company will without doubt be of merit.

Reviewing the trade situation of 1895 and the present outlook, the Chicago Belting company writes: "We are having an extremely active trade and our increase in business of '95 over '94 was more than double. We have an order now under way for the largest leather belt, to our knowledge, in the world. We had a double hydraulic belt press built, which has just been completed, to accommodate this belt, and this, with other improved machinery placed in the factory, places us in position to handle orders of any magnitude. The belt referred to will be 84 inches wide, three-ply heavy leather, approximately 160 feet in length, and will weigh when completed over 1½ tons."

Western Manager F. E. Donohoe of the American Electrical Works was in attendance at the Northwestern electrical convention during the entire time the meeting lasted. Mr. Donohoe kept his company in close touch with the Northwestern delegation and added many friends to his already long list. It will be recollected that Mr. Donohoe came West a year or so ago to establish this company's western department. He opened a handsome store at 241 Madison street, Chicago, and the company's policy of keeping a large stock in the western metropolis has already reverted decidedly to its interests. Mr. Donohoe's policy is, "good goods on the spot at fair prices," and last but not least immediate shipments. With these strong cards in its favor the western department has been remarkably successful and has borne out the wisdom of the company's policy.

At the annual meeting of the Perkins Electric Switch Manufacturing company of Hartford, Conn., the usual handsome dividend was declared, and much satisfaction was expressed at the large increase shown in the business for the year. General Manager J. J. Gates and Secretary F. W. Davis resigned their positions with the company. The business will be continued with C. G. Perkins as president and Edward W. Hooker as secretary. Mr. Hooker is well known in Hartford through his connection with the Broad-brook Manufacturing company, and enjoys a large acquaintance among the leading business men of Connecticut. The selling department will be in charge of C. I. Hills, with headquarters in New York. The Chicago, Philadelphia and Boston offices will continue as previously, and will be in constant touch with the main office, insuring the prompt delivery of goods as heretofore.

The spring manufacturing business of the house of Wallace Barnes of Bristol, Conn., was established by the late Wallace Barnes in 1857, and is now conducted by the administrator of his estate, C. F. Barnes, who has been identified with the house for the last 15 years, assuming the continuance of the conduct of its business at the period of its founder's decease, March, 1893. The plant covers an area of 100 by 150 feet, including a three-story building, hardening shops, die house, etc. The machinery equipment is of the latest improved patterns, and includes many expensive automatic machines for special electrical and bicycle work. Here a force of 50 skilled and experienced hands is provided with constant employment. The range of productions embraces springs made of brass or steel, from the very minute spiral to large coiled motor springs. This house is one of the largest and most responsible of its type in the country, and its trade constitutes an important feature of the commercial and manufacturing resources of Bristol.

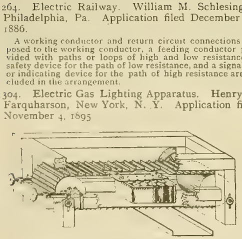
# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued January 21, 1896.*

553,264. Electric Railway. William M. Schlesinger, Philadelphia, Pa. Application filed December 21, 1886.

A working conductor and return circuit connections opposed to the working conductor, a feeding conductor provided with paths or loops of high and low resistance, a safety device for the path of low resistance, and a signaling or indicating device for the path of high resistance are included in the arrangement.

553,304. Electric Gas Lighting Apparatus. Henry C. Farquharson, New York, N. Y. Application filed November 4, 1895



NO. 553,446.

A spark point-holder formed of a refractory substance that is a non-conductor of electricity is employed. It is perforated, and the spark points are introduced in the perforation and there are screws for holding the spark points, and wires for the electric circuit are clamped to the screws.

553,328. Incandescing Electrical Conductor. Jonas W. Aylsworth, Newark, N. J. Application filed July 27, 1894.

The filament is formed of the so-called elementary substance "[illegible]" deposited upon a conducting base or support such as carbon.

553,330. Electric Gas Lighting Apparatus. Henry W. Brinckerhoff, Brooklyn, and Henry C. Farquharson, New York, N. Y. Application filed April 8, 1895.

The [illegible] with a gas burner and its chimney, of spark points and conductors for directing a current of electricity to light the gas, and a shield and a thermostatic device [illegible] upon the shield to move the same and protect the spark points when the gas is burning.

553,335. Electric Arc Lamp. Edward H. Crosby, Boston, Mass. Application filed May 27, 1895.

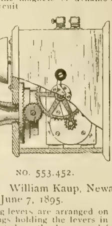
[illegible] arranged carbons are mounted to move longitudinally in combination with electrically actuated mechanism for spreading the adjacent ends of the carbons to strike the arc, and mechanism connecting the upper portions of the carbons for automatically feeding the same longitudinally and conjointly are described.

553,361. Automatic Toll Box for Telephone Pay Stations. Howard C. Root, Brooklyn, N. Y. Application filed March 22, 1894.

A single slot and an inclined chute are provided for the introduction and passage of various sizes of toll coins, and a series of mechanical signal-producing devices combined with the chute and within the box, whereby the different sizes of toll coins in passing through the chute will operate different numbers of the signals.

553,364. Telephone Call. James G. Smith, New York, N. Y. Application filed August 17, 1895.

Included in the arrangement are a main circuit, a normally open spur circuit leading therefrom, a magneto or dynamo-electric machine located on the spur circuit, a toothed wheel and a vibratory or oscillatory switch arranged to be continuously vibrated or oscillated during a single rotation of the wheel to close the spur circuit, and thus introduce the magneto or dynamo-electric machine into the main circuit



NO. 553,452.

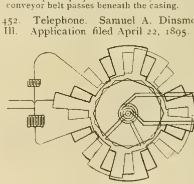
553,410. Trolley. William Kaup, Newark, N. J. Application filed June 7, 1895.

Guard-carrying levers are arranged on opposite sides of the wheel, springs holding the levers in normal position, and guards pivoted on the levers and free to gravitate a limited distance when the trolley pole is reversed.

553,446. Magnetic Extracting and Separating Machine. Frank J. Barnard, John C. Moore and John D. Atkinson, Seattle, Wash. Application filed February 27, 1895.

There is a non-magnetic casing having a suitable top, by which the casing is secured to the frame of the apparatus, and there are a number of perforations in the casing for permitting a free circulation of air. Magnets are secured to the top and project downwardly within the casing, and a conveyor belt passes beneath the casing.

553,452. Telephone. Samuel A. Dinsmore, Chicago, Ill. Application filed April 22, 1895.



NO. 553,469.

In this device there are a movable transmitter, a signaling device, a disk or wheel associated with the transmitter, so that the motion of the disk or wheel moves the transmitter and an operative connection between the disk or wheel and the operating handle of the signaling device.

553,469. Alternating Current Motor. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed November 17, 1892; patented in France March 19, 1890; in Germany July 31, 1890; in Belgium January 9, 1891; in England January 12, 1891; in Italy January 13, 1891; in Spain March 5, 1891; in Austria-Hungary June 16, 1891, and in Switzerland September 12, 1891.

A two-phase alternating current motor is described, comprising two sets of field coils in parallel branches of a single-phase alternating current circuit, condensers for shifting the phases of currents in the two branches with reference to each other, an armature having two independent circuits, each closed upon a like resistance, and means for decreasing the resistances alike when the speed of the armature increases, and for increasing the resistances alike when the speed of the armature decreases.

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## Electric Power Transmission at Niagara.

By Orrin E. Dunlap

The power development at Niagara Falls is rapidly progressing beyond the most sanguine expectations of the hopeful persons who have predicted a grand future for the Niagara locality. Only recently the Niagara Falls Power company, which owns the big tunnel, announced its intention to enlarge its wheel-pit and central power station to make room for seven more 5,000 horse power turbines and generators. Bids for the work have been received and the active steps of the extension will soon be taken. Another project of great interest is that of the Niagara Falls Hydraulic Power & Manufacturing company, which is actively engaged in erecting a power house in the gorge at the water's edge to increase the supply of power. This latest power house at Niagara is to receive its water supply from the hydraulic canal. A sketch showing the general features of the project is presented in Fig. 3.

The hydraulic canal is the oldest power project at the Falls. It is an open waterway which diverts a portion of the water of the upper river from its natural channel and conducts it to a basin situated a short distance (300 feet) back from the high bank of the lower river, from which basin it is conducted by flumes to the penstocks of the turbines of the mills now operated there. For the last few years the owner of this canal, the Niagara Falls Hydraulic Power & Manufacturing company, has been expending a large amount of money in widening its possession in order to obtain a greater water supply and thus increase the power facilities. The work of enlarging the canal is now practically completed, and the company has prepared plans and commenced work on what is destined to be a power house and plant of considerable magnitude.

This new power house is to be located on the sloping bank at the edge of the water in the river below the falls. It was necessary to clear the site of the broken rock and bowlders which had laid undisturbed for centuries in order to prepare for the construction of the building. In some places this mass was from 75 to 100 feet deep and represented the droppings from the high cliff for ages. The removal of this debris was, in itself, no small task, but the service of a giant or monitor was utilized for the first time in the locality, if not in the East. This machine is very extensively used in the gold mines in the West for excavating by means of a powerful stream of water. When the debris was all removed a substantial stratum of Medina sandstone was found, and on this the new power house will be erected. A view showing the progress of the construction work is given in Fig. 2.

The building will be of stone, 60 feet long and 100 feet wide, but ultimately, as demand for power makes it necessary, the length of the building will be extended. For this plant water will be carried in an open canal from the basin before referred to, to a forebay 30 feet wide and 22 feet deep, which is now in process of construction between the edge of the high bank and the basin. A view of this canal is presented in Fig. 1. From the forebay penstocks of flange steel, eight feet in diameter, will conduct the water down the slope, a distance of 210 feet, to the power house at the edge of the water in the lower river. These penstocks will lead from the forebay vertically about 135 feet to the top of the bank slope, thence down this slope to the side of the power station next to the bank, thus making the total length of the eight-foot pipe about 240 feet. Pipes 10 feet in diameter will run horizontally into the building and be suspended over the tail-race leading from the station. The thickness of the steel in these pipes will be fifteen-sixteenths of an inch. All horizontal joints will be butt-strapped and held with three rows of rivets on each side. The cross seams will be all double riveted. The total pressure on the end of the pipe will exceed 1,000,000 pounds, thus making strong work in all parts necessary.

FIG. 1. ELECTRIC POWER TRANSMISSION AT NIAGARA.—CANAL LEADING FROM BASIN TO FOREBAY.

At the start four turbine wheels of the horizontal type, having a capacity of about 7,000 horse power, will be located on the first floor of the station. Each turbine will be fed by a separate penstock and work under a head of 210 feet, which is said to be the highest head under which water has ever been used in the quantity proposed in this new Niagara plant. It is for this reason, to counteract the effect of the enormous pressure, that every detail of the penstocks and water wheels has been designed with the greatest care. From the horizontal portion of the penstock the water will pass up through 60-inch valves on to the outer wheels, which will be supported upon iron beams stiffened by braces built into the side of the tail-race. The turbines will be mounted on horizontal shafts of the double discharge design. They will be fitted with runners 74 inches in diameter, made of extra quality bronze metal, and equipped with balanced gates. They will be so designed that the wheel runners are absolutely balanced by the equal discharge of water on each side, thus avoiding the use of end-thrusts on the shafts. They will be set in cases 11 feet in diameter, made of the best heavy plate steel and double riveted. The feeder pipe connections to these large cases will be on the bottoms of the same, being riveted directly to the five-foot hydraulic cylinder valves, all of which valves will be connected to the main feeder pipe, which will be 10 feet in diameter, and occupy space under the turbines between the foundation walls. Down each side of the main feeder pipe draft-tubes from the turbines will pass, connecting with the tail water, which will be set at a depth of 27 feet from the center of the turbine shaft. These shafts will be of the very best quality hammered wrought-iron carried in adjustable ring oiling bearings and mounted on heavy cast-iron bridge trees.

James Leffel & Co. of Springfield, O., will build the four initial wheels for this station. Three of them are guaranteed to develop 1,700 horse power under a head of 205 feet, which is the minimum head estimated as obtainable, and to run at a speed of 250 revolutions per minute. As the ordinary head used will be from 210 to 215 feet, the power from these wheels, it is expected, will be from 1,800 to 2,000 horse power each. These three wheels will be connected to six electrical generators, two to each wheel, the power product to be used by the Pittsburg Reduction company, manufacturer of aluminum, in a new factory to be built on the top of the high bank, to which point the electric energy will be transmitted. The fourth wheel will be connected to two 560 kilowatt generators and will make 300 revolutions a minute. By this means a 500 volt current for street railway or general power purposes will be obtained. W. C. Johnson, chief engineer of the company, is in charge of the work.

Close beside the Canal company's works the Cliff Paper company is building a new power house in which it will generate electricity for use in its paper mill. This paper company has a pulp mill at the water's edge in the gorge and its paper mill on the top of the high bluff, and thus secures a double service from the water. This double use of water was quite an innovation, and has brought discredit upon the saying that "the mill will never grind with the water that is passed." Now, however, this progressive company is about to take another step to practice economy, and will adopt electricity to succeed steam to run its paper machines. When this proposed electrical plant is installed it will supplant three steam engines of over 200 horse power. Preparatory to the adoption of the electric current, this company will build a stone power house, 20 by 30 feet in size, close to the pulp mill. The penstock leading to the pulp mill

will be tapped and a portion of the water diverted to run a 250 horse power turbine to which will be attached two 125 horse power generators. The head of water on this turbine will be 125 feet. Up in the paper mill two electric motors of 100 horse power each will be attached to each of the paper machines, and besides two motors of five horse power each will furnish power for the small machinery about the mill.

The capacity of the Niagara Falls Paper company's plant on the lands of the Niagara Falls Power company is to be doubled. The paper company was the initial user of tunnel power, and this enlargement is significant of its estimation of it. At present the mill is using about 15,000 cords of wood a year, and when the enlargement is made it will use about 40,000 cords. The increase calls for about 3,000 additional horse power, and a contract for it will be made with the Niagara Falls Power company within a few days. This additional power is practically covered by the company's option on extra power. It will be recalled that this company has its own wheel-pit, which is connected to the main tunnel by a lateral tunnel. The turbines used are made by R. D Wood & Co. of Philadelphia, and the necessary new wheels will be made by the same firm. They are of the inverted pattern with vertical shaft and each has a capacity of 1,100 horse power. The capacity of the present wheel-pit is 8,000 horse power, which will still leave some to spare after the new turbines are placed. This company's pulp mill has a capacity of 40 tons a day, and another mill of the same capacity will be built. Still another new building will be used as a sulphite mill of 30 tons a day capacity. Another new building will be devoted to an additional steam plant, the capacity of the new boilers to be 750 horse power. In preparation for this extra work and product the company has purchased a large tract of spruce wood in Michigan and new vessels are to be put on to bring this wood to the mill. Most of the new machinery has been ordered, and work on the buildings will soon commence

## Milwaukee Street Railway Sold.

A Milwaukee press dispatch states that on January 29th William Nelson Cromwell of New York bought the property of the Milwaukee Street Railway company for $5,000,000. He made the bid on behalf of C. W. Wetmore, Arnold Marcus and himself of New York and Frank G. Bigelow, Charles Pfister and B. K. Miller, Jr., of Milwaukee. Mr. Cromwell's bid was the only one made, and Frank M. Hoyt, the special master in chancery, announced him as the purchaser of the road. Mr. Cromwell made a deposit of $150 000 in bonds of the road for the faithful performance of his part of the contract. B. K. Miller, Jr., said that he and the other purchasers of the road comprise a bondholders' committee, and that a reorganization will be at once perfected under the name of the Milwaukee Electric Railway & Light company, with a capital stock of $8,000,000, of which $4,500,000 shall be preferred stock and $3,500,000 common stock. The sale included all the property of the Milwaukee Street Railway company, comprising its real estate and buildings, tracks, power plants, franchises and privileges, 7,990 shares of stock in the Badger Illuminating company, 2,400 shares in the Whitefish Bay Railway company (the old Hinsey company) and 3,000 shares in the West Side Street Railway company. The sale was under foreclosure proceedings on two consolidated mortgages for $10,000,000 and $1,265,000, dated December 27, 1890, and September 14, 1893, respectively, upon which there was due a little over $9,340,000.

## Storage Batteries on the Manhattan Elevated.

The issue of New York in its issue of February 2d makes this announcement: "The Electric Storage Battery company of Philadelphia has obtained permission of the executive committee of the Manhattan Railway company to make an experimental test of its motors on the branch of the elevated railroad from Third avenue to the Thirty-fourth street ferry. This fact has given rise to rumors, which were circulated in Wall street yesterday for stock-jobbing purposes, of a deal between the General Electric, the Storage Battery, and the Manhattan Railway companies."

The West End Street Railway company of Boston has just placed an order with the General Electric company for four 1,200 kilowatt generators and one 1,500 kilowatt generator, making a total of 6,300 kilowatts in five units.

## The 220-volt Lamp Question.

By W. N. Stewart.

When the writer, at the convention of the Northwestern Electrical association held in St. Paul some 18 months ago, prophesied that 220-volt lamps would soon come into general use in this country, he met with the usual fate of prophets. When he further bid upon plants, both central station and isolated, calculated for the use of such lamps, he met with nothing but scorn and abuse from his competitors. And it is probable that even to-day a large number of usually well informed electricians would most heartily condemn and disparage any such revolutionary departure from recognized practice.

And yet in a recent number of the Western Electrician we find a report from the distinguished Prof. Kennedy, in which he recommends the municipality of Edinburgh to replace their 110-volt lamps with those of 230. The big St. Pancras station in London uses nothing else, while all over England they are coming into general use

When, in this country, I first tried to get the lamp-makers to produce a practical high-voltage lamp, I met with scant encouragement. To-day fairly good lamps are made by most makers and excellent ones by others, while the standard of efficiency is being raised from the original four or more watts per candle to the European standard of three and one-tenth. In the eighteen months since the respected members of the Northwestern association considered me a fit subject for a commission *de lunatico inquirendo*, myself and my esteemed competitors have established in the Northwest over 15 central stations using 220-volt lamps and no others, and most engineers in this section now specify the system exclusively. Many large plants are also in use or under construction east of Chicago.

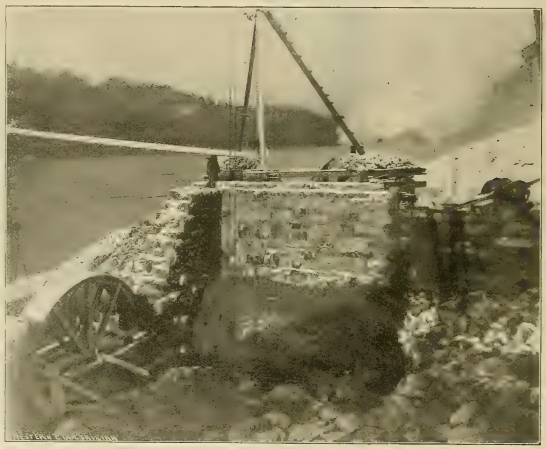

FIG 2 ELECTRIC POWER TRANSMISSION AT NIAGARA.—FOUNDATIONS FOR THE NEW POWER HOUSE AT THE WATER'S EDGE IN THE GORGE

It now seems to be pretty well established that for village work a two-wire, 220-volt system comes pretty near to the ideal. A single compound wound, self-regulating dynamo lights streets and houses with arc and incandescent lamps, as desired, and if this dynamo is a slow-speed, direct-connected machine, as it ought to be, the engineer has what is known in common speech as a "soft snap." Using a common negative wire for both street and commercial circuits insures a constant potential on every lamp, regardless of changes of load on the commercial circuit—a condition of things which cannot be had if distinct circuits are used from a single machine, while, as only three wires are used, the simplicity of the system is evident

Careful experiments lasting over many months show that the danger from fire is less with 220-volt lamps than with any other. The danger in any incandescent system is not from voltage but from current. The small fuses used on 220-volt systems give way at the slightest approach of danger, while sockets spark less with high than with low voltage lamps. Some of the 10 ampere branch blocks on the market should not be used, even for 110 volts, but outside of these there is no trouble. With good workmanship, a 220-volt system is safer than any other, and bad workmanship is going out of favor.

There is another surprising piece of information connected with 220-volt lamps, which to my knowledge has not become public property; that is, that these lamps last longer and blacken less than the common style. The life of most of these lamps averages 1,500 hours or over, while the blackening is almost negligible. The reason for this phenomenon will readily suggest itself to the expert.

The 220-volt lamp has come to stay, and it will play a large part in the central station and isolated work of the future. The writer is quite satisfied to bear up patiently under the bad language of some of his electrical friends, in the hope that, as even the vilest sinner may return, they may in time come to appreciate the merits of an article which marks an epoch in the history of the art.

## Burying the Wires in Baltimore.

The annual report of U. S. Hill, Jr., engineer of the Electrical Subway Commission of Baltimore, contains interesting figures: Of the work completed, 129,224 feet, or 24½ miles, of conduits is built, and contain 366,388 feet of electrical ducts; 90,498 feet of the conduits are laid beneath cobblestone pavement; 33,460 feet under Belgian blocks, 24,286 under asphalt blocks, 2,838 under sheet asphalt. The average cost per mile has been $3,050.99. While $200,000 was appropriated for the work, nearly $1,000 more than that has been expended. Engineer Hill recommends strongly in his report that all the wires in the city, be placed underground. He has made an estimate of the cost for a general subway system and believes the work can be done for $1,467,000. His idea is to require, through legislation, all companies having wires to place them in the city's conduits and pay to the corporation an annual rental for the use of the subway. By this plan he thinks the rents will soon pay the cost of constructing the system

## No Motor Like It.

The following information is given in a dispatch from Emporia, Kas., to the *Topeka Capital*. "Mr Stevens, of the Kansas State Normal, has invented an electric motor which is a little the best so far made When attached to a battery of equal strength, it exerts more pounds of force than the other kind of motors The model has four fields, and five armatures so constructed that only one armature is even with a field at the same time, thus giving it a regular speed, with no jerking It has been examined by practical electricians and pronounced good. The patent attorneys say that no motor like it has been patented and this application for a patent will be granted."

## Water Supply of Niagara.

By Orrin E. Dunlap.

In their annual report to the New York Legislature the commissioners of the State Reservation say: "If the United States and Great Britain refuse to interfere, there is nothing to prevent the state of New York and the province of Ontario from drawing off so much water from the upper Niagara as to make the cataract practically disappear." This official protest is evidence that the commissioners will be found in opposition to further power development, but it does not follow that they will be supported by public sentiment in their stand. Up to this time eight companies have secured franchises for power rights. This includes both sides of the river. However, these eight companies are not diverting water for power, nor are they likely to, because capital is not with them. The three companies to be considered seriously in the Niagara power development are the Niagara Falls Power company, the Niagara Falls Hydraulic Power & Manufacturing company and the Canadian Niagara Power company. The first two are New York state incorporations, while the latter is a Canadian concern and will divert water from the river on the Canadian side, at the Horseshoe or Canadian Fall. These three companies have ample capital back of them to perfect their projects, but as the Reservation

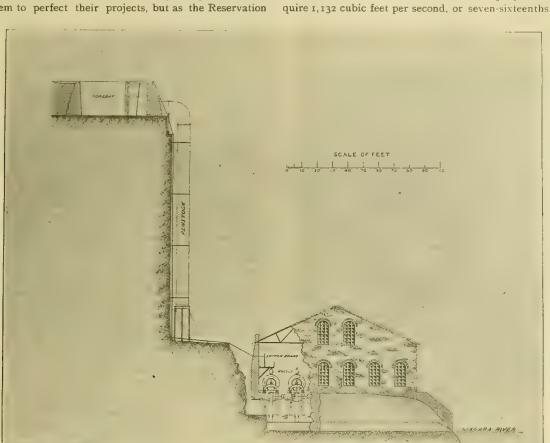


FIG. 3. ELECTRIC POWER TRANSMISSION AT NIAGARA.—SKETCH OF GENERAL FEATURES OF THE PLANT.

Commissioners have to do with the New York state possession, only two of the companies must be considered as relating in any way to the interests they are supposed to guard. These companies are the two first named, and the plants of both are now in operation. Because the commission makes the statement, it does not follow that it is accurate. In fact there is evidence from high authority that the Falls of Niagara are in little danger from the results of power development. This authority is no less than the eminent hydraulic engineeer, Clemens Herschel, who has recently written a very able paper on the subject which contains much that is of importance to the electrical and engineering worlds at this time. In this paper Mr. Herschel refers to the anxiety of the Reservation Commissioners, and he expresses the belief that they should have considered the question one of quantity or measurements before passing judgment. He cites the fact that the grant to the Niagara Falls Power company is "no more water than shall be sufficient to produce 200,000 effective horse power." He then ventures the off-hand assertion that this, when construed, is likely to be taken as meaning a grant in the vicinity of 13,333 cubic feet per second, or about five per cent. of the flow of the river. With good judgment he recognizes that the discharge of the river varies greatly from day to day, from season to season and from year to year. He calls attention to the fact that the level of all the great lakes varies two feet a year and six feet during a period of years. Thus, he points out, the discharge of the Niagara river must and does depend largely on the lake level. Other causes have a tendency to vary the flow of the river, even while the same volume of water is present in Lake Erie. The most potent of these is the direction and intensity of the wind and its effect on the lake level at the intake of the Niagara river. Still another cause is the presence of ice at the head of the river. He recites that in March, 1848, these two causes combined were sufficient to practically stop all water from flowing over the American Fall, and to give even the famous Horseshoe Fall but a semblance of its ordinary appearance. "These are mighty variations," says Mr Herschel "and compered to any that are likely ever to be produced by the hand of man, are but puny in comparison."

But in order to have a substantial basis for his estimates, Mr Herschel takes the figures of the United States Lake Survey as showing that an ordinary and usual flow of the river has been found, by gauging the river near Black Rock, to be 265,000 cubic feet per second. Of this he estimates the grant to the Niagara Falls Power company will take, in time, 13,333 feet per second, or five per cent. of the flow of the river; the wheels of the Niagara Falls Hydraulic Power & Manufacturing company, and of its tenants, require 1,650 cubic feet per second, or about five-eighths of one per cent. of the river's flow; while leases of the same company will require 1,132 cubic feet per second, or seven-sixteenths of one per cent. of the river's flow. In order to estimate the effect the withdrawal of these quantities of water would be likely to have on the falls, Mr. Herschel truthfully assumes that the American Fall, at an ordinary stage of the river, consists of a sheet of water four feet thick flowing over a broad dam 900 feet long. Such dam would discharge 22,259 cubic feet per second, or about one-twelfth of the flow of the whole river. It is supposed the remaining 242,741 cubic feet per second flows over the Horseshoe Fall, 1,500 feet long, at a depth of 14 feet. Mr. Herschel then finds that for every 5,000 cubic feet of water per second diverted from the river, the American Fall would lose five-eighths of an inch in thickness, out of its four feet of thickness, while the Horseshoe Fall would lose 2¼ inches out of its 14 feet. Thus, by the time the Niagara Falls Power company shall have grown from its present possible use of 18,000 horse power to the full capacity of its tunnel, or to 100,000 horse power, and from that to the construction of another tunnel of the same capacity, the sheet of water passing at ordinary times over the American Fall will have dwindled from 4.00 feet down to 3.87 feet, and that of the sheet of water passing over the Horseshoe Fall from 14.00 feet to 13.54 feet. Should the Niagara Falls Hydraulic Power & Manufacturing company receive a like grant from the state and in time come to use it all, the two companies taken together would then cause the American Fall to have a depth of 3.74 feet instead of 4.00 feet, as at ordinary times, and the Horseshoe Fall a depth of water of 13.08 feet, instead of 14 feet. Mr Herschel then cites the fact that the consumption of water for domestic uses in rapidly growing cities increases at the rate of from 50 per cent. in 10 years. At the larger rate of increase the present use of less than 30,000 horse power at Niagara Falls would grow into a use of 300,000 horse power in about 1960. Thus an unrestricted growth of manufacturing at Niagara Falls would only have reduced the flow of the Niagara river in 1960 from 265,000 cubic feet per second down to 248,444 cubic feet per second, and the depth of the water as mentioned, which would be no appreciable detriment to the scenery.

## Central Station Economies.[1]

By Leland L. Summers.

It is not difficult to find points to criticize in the design of the older stations when one uses modern practice as the basis of comparison. It is, however, very difficult

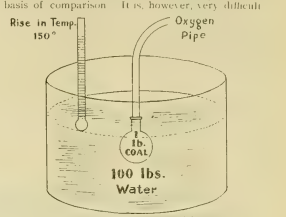


FIG. 1. CENTRAL STATION ECONOMIES.

sometimes to say just what changes are economical in a station already in existence. It is the dollars and cents account that appeals to one under these circumstances, and not what class of machinery is used, or what the efficiency is. In the design of a new station the dollars and cents may depend entirely upon the efficiency, and usually do. But with an older station we are not at liberty to discard engines already in position for those of a more economical pattern, nor are we allowed to shift the plant around without regard to expense, as the station may already be handicapped with a bonded indebtedness which will not permit of further favors in this direction. The question is: How can the station which is not deriving a proper income from its service be improved without the expenditure of an amount which would be prohibitory?

Mr. Buckley, in his paper, has touched upon many of these features, and I shall only attempt to supplement some of the points he has brought out by giving results of actual efforts in this direction. I have chosen to illustrate some of these remarks with tests taken from a small country station. In considering the value of fuels as steam producers we practically need only deal with the subject of coal. But the variation in price and the wide difference in results obtained from the various coals upon

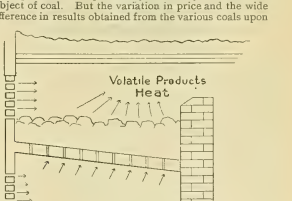


FIG. 2. CENTRAL STATION ECONOMIES

the market indicate at once that there is a great difference in them as steam producers. If we turn to a chemical analysis of the various coals we will ordinarily find practically the same constituents, but a difference in the amounts which are contained in the fuel. Furthermore we find that there are two different analyses ordinarily made, one being known as the ultimate and the other as the proximate. The proximate analysis is ordinarily the one made, as it does not need the apparatus required for the ultimate analysis, and enables an idea to be formed of the constituents of the fuel. The proximate analysis usually determines the amount of carbon, volatile matter, sulphur, ash and moisture there is in the fuel. It will be noticed that volatile matter is considered as a whole rather than the constituent parts of which it is composed. The calorific value or heat-producing power of the coal is dependent upon the chemical constituents, but the chemical analysis is only an approximate way of ascertaining the heating value of the fuel. With an ultimate analysis in which the volatile matter is separated and the amount of hydrogen, hydro-carbons, etc., ascertained, it is possible to figure out with a fair degree of

[1] Address delivered before the Northwestern Electrical association, Milwaukee, January 16, 1896.

accuracy the heat contained in the coal. With a proximate analysis the calculations of the heating value of the coal are more or less approximate. Under these circumstances it has been the practice to determine the heating value of the coal by measuring its heat producing power directly, and not by calculating it.

As you are all aware, the heating value of the fuel is ordinarily expressed in British thermal units, a British thermal unit being the amount of heat required to raise one pound of water 1° Fah. While there is a slight difference in the amount of heat required to raise a pound of water one degree at different ranges of temperature between 32 and 212 degrees, this difference is so small that it is practically neglected, so that throughout the range from 32 to 212 degrees it is considered that one thermal unit will raise one pound of the water one degree in temperature. As the value of the fuel is to be expressed in British thermal units, evidently one of the simplest ways to ascertain its heating value is to surround a given quantity of fuel with a given weight of water, and measure the rise of temperature of water as the fuel is consumed. There are many refinements necessary in making this test, such as preventing radiation, insuring complete combustion, etc., but we need not consider these, as it will unnecessarily complicate the elementary presentation of it.

If we have a vessel (Fig. 1) and place 100 pounds of water in it and submerge in this a second vessel of very thin metal containing say, one pound of coal, and supply this coal with oxygen and thoroughly consume it, we would find that a given amount of heat would be radiated from the coal receptacle to the surrounding water. Suppose this rise in temperature was found to be 150 degrees. We would then consider that inasmuch as 100 pounds of water had been raised 150 degrees, there was $100 \times 150 = 15{,}000$ British thermal units.

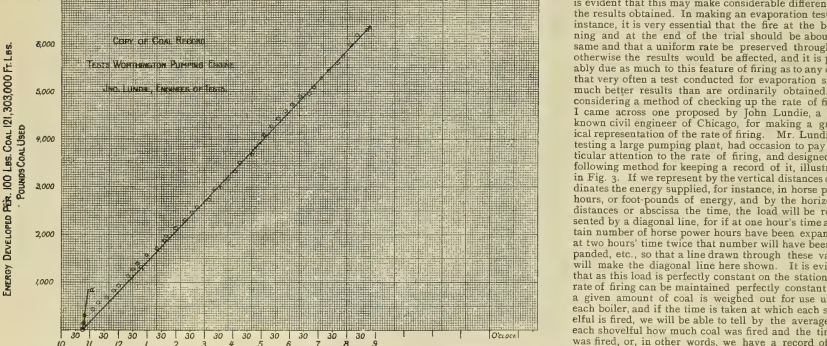


FIG. 3. CENTRAL STATION ECONOMIES.

It will be seen by this method of testing that it will not require any chemical analysis of the coal proper to determine its heating value, and with a properly constructed instrument for this determination, various coals may be compared and their heating values directly obtained.

After ascertaining the actual heating value in the fuel, the question arises how much of this is available for power purposes under the ordinary conditions of steam generation. In order to generate steam it is necessary first to raise the temperature of the water to 212°, then to add a certain amount of heat in order that the water may expand into steam, and if we wish steam at a higher temperature than 212°, or a higher pressure than the atmosphere, we must add another amount of heat to raise it to the required pressure. Suppose then we start with water at 32°. To raise one pound of water to 212° it will require $212 - 32 = 180$ heat units.

Now it has been ascertained by repeated experiments that it requires 966 heat units to expand water into steam after the water has been raised to a temperature of 212°, so that it would require $180 + 966 = 1146$ heat units to raise the water from 32° to steam at 212°.

Suppose it is intended to use the steam at a pressure of 100 pounds. This would require a temperature of about 337°, and it would be necessary to raise the steam from 212° to 337° or 125°. Now it has been ascertained that it requires about $\frac{1}{4}$ of a heat unit to raise one pound of steam one degree. So then it will require $125 \times \frac{1}{4} = 47$ heat units to raise the steam to 100 pounds pressure, and the total heat units required to generate steam at 100 pounds pressure from the feed water at 32° would be 180 heat units to heat the water, plus 966 heat units to make the steam, plus 47 to raise the steam from 212° to 337°, making about 1,193 British thermal units as the amount of heat required to raise one pound of water from 32° to steam at 100 pounds pressure. It will be noticed from this that if we consider steam as being evaporated from 212° and consider the feed water as being furnished at 212° it will only require 966 heat units to generate the pound of steam from the pound of water. So that it has become standard practice in order that boilers may be compared, to consider the feed water as supplied at 212° and the steam generated at 212°, or in other words, from and at 212°; that is, as requiring 966 heat units to evaporate one pound of water. Under these circumstances it will be seen that with coal having a heating value of 15,000 heat units, if all this could be utilized the number of pounds of water evaporated from and at 212° would be $\frac{15000}{966}$, or 15.4 pounds of water per pound of coal. But under the conditions of actual evaporation there would only be obtained $\frac{12880}{1000}$, or 12.6 pounds of water per pound of coal.

This, it will be remembered, would be obtained if the boiler were perfect, and there were no losses due to radiation, or to the heat wasted in the stack in order that a draught may be created. If in actual practice there was obtained an evaporation of eight pounds of water per pound of coal, using the same kind of coal, we would see at once that our boiler was $\frac{8}{15.4}$, or 66 per cent. efficiency, and, when calculated as from and at 212°, the evaporation would be $15.4 \times .66 = 10$ pounds.

In applying these considerations practically, the efficiency of the boiler will depend, first, upon its design, and, second, upon its setting, neither one of which can ordinarily be changed, so that we can only improve the conditions by perhaps changing the quality of the coal, or by insuring a more perfect combustion of the fuel. It is evident that if a better grade of coal is used, or a coal that possesses a greater number of heat units, more power can be obtained from the boiler with a given consumption of fuel.

Whether it is economy to consume the better grade of coal will depend largely upon the location of the plant and the freight rates, so let us confine ourselves to the subject of the combustion of the fuel. When coal is first thrown upon the fire it absorbs heat from the fire, and the first effect is to drive off the moisture and the volatile products. If the furnace temperature is sufficiently high these products may be ignited and consumed, and their heat may be utilized in generating steam. If, however, in throwing in the coal the temperature of the fire has been lowered by the coal absorbing the heat, and also by the inrush of air through the fire doors, it may not be possible to have the volatile products ignited when they are driven off, and they thus escape to the chimney unconsumed. In this way it leaves only the fixed portion of the fuel to produce the heat. Under these circumstances it is evidently best to maintain the furnace at as high a temperature as possible, and for this purpose to admit only the required amount of air. If too much air is admitted the temperature of the furnace will be lowered, and some of the heat will be wasted which escapes to the chimney. In order to govern the amount of air an even fire is maintained upon the grates, so that no portion of the grate will be left uncovered and allow the air to rush through the fire. For this purpose the back end of the grate is often lowered, as in Fig. 2, so that the back part of the furnace has a slightly heavier bed of fuel than the front part. In order to insure a sufficient quantity of air to thoroughly consume the fuel, the fire doors are usually perforated so that some air is admitted over the fire. One of the smaller devices successful in a device for heating the air first and then admitting it to the fire. In this way there is not the tendency to lower the temperature of the furnace by admitting cold air directly, and a more perfect combustion is often secured. The common method of firing coals, which have a considerable amount of volatile matter is to fire them near the front of the furnace so that the volatile matter when driven off will have to pass over the bed of incandescent fuel between the bridge wall and the dead plate, and in this way will be more apt to be consumed (Fig. 2). If large amounts of coal are fired into the furnace at one time it is evident that most of the volatile matter will escape unconsumed. The chief difference between eastern and western bituminous coals consists in the percentage of the volatile matter there is in the coals. Owing to the fact that the eastern coals have more fixed combustible and less volatile combustible, they give a higher evaporation, as it is not possible in the ordinary furnace to utilize the lighter volatile products.

Under these circumstances it is not unusual to find coals which may contain about the same number of British thermal units giving widely different results in practice; an eastern coal running, say, about 14,000 British thermal units, may give from nine to 10 pounds, and a western coal only from five to eight pounds.

After the consideration of firing coal so as to consume it as thoroughly as possible, it might be well to consider what proportion of the coal is wasted through the grates. That is, as to whether the grates are properly designed for the particular fuel being used. Often the coal is not weighed and still less frequently the ash. If the coal were to be weighed from the same car from the ash is weighed, dividing the weight of the ash by the weight of the coal would give the percentage thrown away as ash. This might possibly contain some small particles of fuel, and in order to determine what percentage is actually consumed, sample chemical analysis of the fuel were made, which would show the ash remaining from the coal when the combustion had been perfect. Under these circumstances considerable difference might be found, as in a case recently came I found there was 25 per cent. of refuse, while a chemical analysis showed there was 13 per cent. of ash. Under these circumstances 12 per cent. of the coal was being thrown away as refuse. Changing the grates so that they were better adapted to the fuel resulted in a very material saving. One of the most difficult features to judge of is the condition of the fire under the boiler and whether the firing is being done at a proper rate, for it is evident that this may make considerable difference in the results obtained. In making an evaporation test, for instance, it is very essential that the fire at the beginning and at the end of the trial should be about the same and that a uniform rate be preserved throughout, otherwise the results would be affected, and it is probably due as much to this feature of firing as to any other that very often a test conducted for evaporation shows much better results than are ordinarily obtained. In considering a method of checking up the rate of firing, I came across one proposed by John Lundie, a well-known civil engineer of Chicago, for making a graphical representation of the rate of firing. Mr. Lundie, in testing a large pumping plant, had occasion to pay particular attention to the rate of firing, and designed the following method for keeping a record of it, illustrated in Fig. 3. If we represent by the vertical distances or ordinates the energy supplied, for instance, in horse power hours, or foot-pounds of energy, and by the horizontal distances or abscissa the time, the load will be represented by a diagonal line, for if at one hour's time a certain number of horse power hours have been expanded, at two hours' time twice that number will have been expanded, etc., so that a line drawn through these values will make the diagonal line here shown. It is evident that as this load is perfectly constant on the station the rate of firing can be maintained perfectly constant. If a given amount of coal is weighed out for use under each boiler, and if the time is taken at which each shovelful is fired, we will be able to tell by the average for each shovelful how much coal was fired and the time it was fired, or, in other words, we have a record of the rate of firing. As we have already represented the time by horizontal distances, in measuring the power we can use the same scale and then represent the pounds of coal used by the vertical scale or ordinates, and we can plot the rate at which the coal was fired along the same diagonal line as the load line. If the firing is properly done it is evident that the amount of coal used should correspond with the power line throughout; that is, for the same time along the horizontal line the pounds of coal used and the energy developed should bear the same relation. In other words, these lines should agree with each other. If the coal was fired throughout as it was in the beginning, as shown in Fig. 3, it would seem that this would have burned the coal at a rate altogether out of proportion to that at which it was fired until about half an hour after the start that the proper rate of firing was inaugurated. Counting the shovelfuls of coal, then, will enable us to trace the line of firing, which should agree with our load line, and if the firing is being done too rapidly, it will show when the results are plotted. I will now plot the results of firing under a variable load (Fig. 4), but it may be well to construct the complete diagram and illustrate with actual figures what may be taken as a typical small country station under actual operating conditions. This will show the relation between the dead load on the station and its relation to the load from which income is actually being derived. This particular station has a 125 horse power four-valve engine, which is of a very economical type for a small non-condensing engine. The actual friction load on this engine, including engine dynamo, driving belt and exciter, amounts to 24 horse power. The station, we will say, starts at 6 P. M., and we will plot the hours on the horizontal scale again to, say, 12 M. It is evident that in one hour we shall have generated in the load of the station 24 horse power hours; in two hours, we shall have generated 48 horse power hours, etc., so that drawing a line through these points we will have a line which we will mark No. 1, Fig. 4. This, it will be understood, is a constant loss of 24 horse power due to the friction of the engine and dynamos, and the load on the exciter due to exciting the fields of the alternating current dynamo, so that it is simply the load on the station in order that it be prepared to supply incandes-

cent light. It is evident that this load will be constant regardless of what load there is on the consumers' circuits, so that it is a load from which no income is derived. Now this particular station also has a small high-speed engine driving an arc light dynamo. The losses on this engine are 0.3 to 0.5 horse power, and we will therefore draw another line representing these constant friction losses, which we will call No. 2. The arc load upon the arc light dynamo would be constant, that is, fairly so. As the number of lights upon it are constant, the only variation on this would be that due to the variable voltage as the lamps adjust and the dynamo regulates to keep the current constant, so that we may represent this as another constant load, in this case amounting to about 2.1 horse power. This line we will call No. 3. At six o'clock the incandescent load upon this station, as shown by a wattmeter, is equivalent to about 70 horse power, and at seven o'clock the load remains at 70 horse power, increasing slightly at eight o'clock, but gradually falling off until 2 A. M.; plotting the results in the form of a curve, we will call this No. 4. By actual measurement of the transformer losses we can draw a constant line above the arc load line, and this we will call No. 5. It will be seen that at practically 1 A. M. the incandescent load line comes down to the transformer loss line, showing that at this hour no incandescent lights are in service, so that no income is being derived from the incandescent service. Under these circumstances the distance between lines 4 and 5 represents the area we are deriving revenue from, the balance of the load being a dead load upon the station. Transferring the line representing the transformer losses, so that these losses may be added to the station losses, we will represent this by a dotted line which we will call No. 6. We see that the distance from line *o*—we will call the axis *o*—the losses from *o* to line No. 6 then are dead losses upon the station which no income is being derived from, while the lines above No. 6 will represent the load we are deriving a revenue from after deducting the transformer losses. When one contemplates this large dead load upon the station, it is readily apparent why there should be such a discrepancy between the figures given for the cost of producing electrical energy in different stations and under various conditions. It is readily apparent that even with the same engines, the same boilers, or in fact the same machinery throughout, the load line or the methods of operating, either one, may affect the conditions in such a way as to entirely preclude the possibility of comparing them directly.

Now in regard to the economy of the amount of fuel consumed under the variable load and the results of considering the rate of firing upon the same general plan which Mr. Lundie pursued in the tests we previously outlined, a record of the firing may be drawn in, and it looks about like No. 7, Fig. 4. In examining this we find that upon the whole the firing line corresponds very well with the load line, but that at different points the rate of firing was greatly altered. From 7 to about 7:20 the firing was altogether too rapid, as it will be seen. This line would run off at an angle. We will mark this point *A*. From 7:30 to 8 the firing line corresponded very well with the load line. We will mark this *B*. From these figures it is apparent that we can tell about what the rate of firing should be and how well it agrees with the load line.

In addition to considering the losses due to station management such as firing, we might consider whether it is possible to diminish any of these fixed losses from which we are deriving no revenue. It is evident that by changing the station design or the size of the units, we might diminish these. At the light load period the station we were considering furnished 15 horse power to line, and almost 10 of this was lost in transformers. Inasmuch as 23 horse power was a fixed station loss, it is evident that 33 horse power was wasted in supplying five to the consumers, and that while the engine could very easily produce a horse power hour on say five pounds of coal, it is evident that it actually required 5×33=190 pounds of coal to supply the five horse power, or in other words there was 38 pounds of coal used per horse power hour supplied to the consumer. It is also evident that the station fixed losses are far greater than the transformer losses on the line. In a plant in which we were endeavoring to diminish the fixed station losses, we considered the advisability of using a storage battery and a direct current motor to drive a small alternating current generator during the periods of light load. It was figured that the exciter for the large alternator might be larger than the ordinary size, and in addition to supplying the current for the alternator fields could charge a storage battery. During the period of average load, in which the large alternator would be performing a carrying a half load, the exciting dynamo would charge the storage batteries and toward the latter part of the evening, when the incandescent load was very light, the engine and large alternator could be shut down and the exciter run as a motor from the storage battery, directly connecting the motor to an alternator of sufficient size to carry the load, which would be very small. In this case there would be many questions to be carefully weighed. The interest and depreciation on the storage batteries, the loss of energy due to charging them and the extra loss due to driving the larger exciter would have to be compared with the saving made by decreasing the station losses. This problem would be a particular one for each station, so that no general conditions can be discussed. Furthermore we have assumed that our machinery is already in position and that no money is available for extensive alterations. The next source of loss, then, would be the transformers. Mr. Buckley has given some figures obtained from stations in which he has replaced the small transformers with larger ones, and from his results it would seem that about 58 or 59 watts were required for each light burning. Of course, in figuring out the watts from the ampere and volt readings of the station, considerable correction may be necessary unless the transformers are fully loaded. With loaded transformers, however, this error may not be more than two to five per cent, so that we may call the averages obtained as being from 57 to 59 watts per lamp. If we assume the lamps were burning about 50 watts, it would leave from seven to nine watts as being lost in the transformers for each lamp that was burning. I have made some determinations of the average losses due to transformers of all sizes in actual operation. In one case there were seven circuits in operation and the station operated only at night, so that it was a simple matter to start the station during the day and have men go to the consumers houses and open the secondary circuits at the fuse blocks. In this way when the current was turned on from the station an accurate determination of the losses could be made. Measurements were made with a direct reading wattmeter. I then took the transformer capacity of each circuit and figured out the watt loss per lamp capacity. These were as follows:

| Circuit. | Watts. | Watts lost in transformer per lamp capacity. |
|---|---|---|
| 1 | 800 | 2.25 |
| 2 | 575 | 2.55 |
| 3 | 825 | 2.32 |
| 4 | 1,000 | 2.67 |
| 5 | 900 | 2.95 |
| 6 | 2,400 | 2.99 |
| 7 | 780 | 3.03 |

If we assume that the average load on the consumer's premises is about one-third the transformer capacity, the watts lost per lamp for the average load would be about three times the figures given, or would correspond very closely with the results given by Mr. Buckley. These tests, as stated, were made with a wattmeter, so that they would be more correct than an approximate

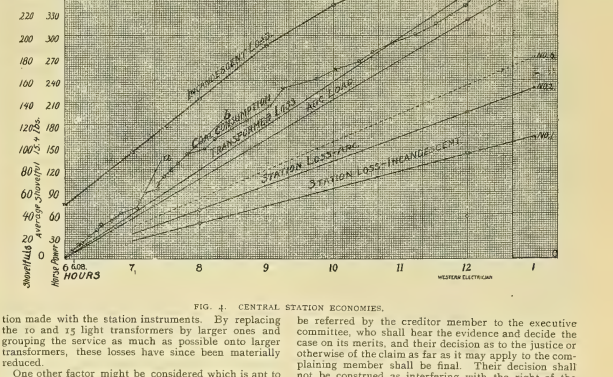


FIG. 4. CENTRAL STATION ECONOMIES.

tion made with the station instruments. By replacing the 10 and 15 light transformers by larger ones and grouping the service as much as possible onto larger transformers, these losses have since been materially reduced.

One other factor might be considered which is apt to prove a source of loss and one which perhaps does not receive the attention it merits. It is well known that there is a pronounced tendency in some of the arc lights upon the market to change their adjustment slightly and gradually lengthen the arc. If arc lights produce a satisfactory arc any increase over this will represent a loss. A voltmeter in the station, if properly calibrated, ought to show the increasing tendency of lamps toward a longer arc, and proper steps might at once be taken to correct this. A portable voltmeter can readily be carried around and a lamp lowered and its voltage taken very easily. So that this source of loss is not difficult to guard against or to correct. But suppose the lamps instead of taking 45 to 47 volts, are taking 53 to 55 volts. It is evident that these eight volts per lamp would represent a loss of about 15 per cent. of the total power supplied, and it may be added that it is not unusual to find from eight to 15 per cent. of energy wasted in this way among the smaller plants where the lamps are brought into the station for cleaning or repairs until absolute failure occurs.

In conclusion, I might say a word in explanation of Mr. Terry's remarks, which seemed to meet with some criticism. Mr. Terry said that the station operating expenses might average only 50 per cent. of the cost of light to the consumer. In other words, a kilowatt hour selling for 15 cents might be produced at the station for eight cents; furthermore, that for a large number of stations 25 per cent. of the capital was a fair estimate of the gross income. In other words, a station having a capital stock of $50,000 might have an income of $12,500 and the operating expenses might be $6,250. That would leave $6,250, or 12½ per cent. upon the capital stock. It is evident that without considering the questions of depreciation, independent of repairs, or the various sinking fund items, this does not provide a very large income, and if 8% per cent. additional is deducted for these items it only leaves six per cent available for interest. Inasmuch as an investment paying six per cent can be made which does not involve any particularly hazardous risks, this is not a satisfactory return on a small plant. Just what income must be obtained in order that a plant may be considered a profitable investment, is quite an intricate problem. It is evident that the death of a man caused by coming in contact with high pressure wires, or any other unusual accident, may wipe out a year's profit, so that these features demand consideration. I might say that in some recent work I had occasion to do for some bankers, it was stated that 15 per cent would be considered a minimum rate of interest for the conditions existing, which, however, did not involve any that were more hazardous than those to be found in the ordinary small electrial plants.

## Electrical Trades Association.

A new organization for the protection of electrical traders has made its appearance in Philadelphia. It is known as the Electrical Trades Association of Philadelphia, and a charter has been applied for. Any manufacturer or wholesale dealer in electrical supplies may become a member, and the principal object is mutual protection in the matter of extending credits. The by-laws contain these provisions:

It shall be the duty of members of this association to refuse credit to, and to sell for cash before delivery only, all parties who shall be reported as delinquents by the executive committee.

In cases where correctness of accounts is disputed and a settlement refused in consequence, the matter shall be referred by the creditor member to the executive committee, who shall hear the evidence and decide the case on its merits, and their decision as to the justice or otherwise of the claim as far as it may apply to the complaining member shall be final. Their decision shall not be construed as interfering with the right of the member to sue the disputant should he so desire.

The list of officers is as follows: President, C. E. Trump, of Novelty Electric company; vice-president, C. M. Wilkins, of Partrick & Carter company; treasurer, P. Logan Bockius, of F. H. Stewart & Co.; secretary, Richard Cadbury, 733 and 735 Drexel building, Philadelphia; executive committee, C. E. Trump, chairman, C. M. Wilkins, A. Bournonville of A. F. Moore, H. G. Kepler of Walker & Kepler, H. C. Roberts of Vallee Bros. & Co.

## Important News from New England.

{From the New York *Sun*.}

Motormen on the electric street cars in Danbury have been supplied with veils to protect their faces from cold and driving snow.

What might be called a "motorman's pose" has been developed by the trolley cars, according to observations made at a ball given by the trolley motormen in Worcester, Mass., last week. It is alleged that while resting between the dances every motorman stood on one foot. When running a car the motorman must stand on one foot and have the other free to pound the gong, the gong being pounded incessantly, as any Brooklynite will testify. Thus a necessity of work has developed into a habit at all times. This is a subject for the consideration of the evolutionist.

The New Orleans Traction company reports a great increase in net earnings. The figures are: 1894, $355,-943; 1895, $583,076; increase, $227,133, or 62 per cent.

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**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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How long is Dr. Henry S. Carhart to continue in the company of his present Chicago associates? This is a question that many persons are asking nowadays.

MILWAUKEE street railway and electric lighting interests have been purchased by a syndicate of New York and Milwaukee capitalists. They announce that the property will be managed upon business principles and that many improvements will be made. In this they will receive the support and encouragement of the people of Milwaukee, and they will be carefully watched by the street railway interests of the country. There is no doubt that the Milwaukee enterprise has been a great disappointment, and the effect has not been lessened by the knowledge that the failure of the enterprise was due almost entirely to poor management. It is to be hoped that under the new owners the company will redeem itself, but to do this more than formal reorganization will be necessary. A complete change will be required before the confidence of the electric railway interests of the country will be regained.

JAPAN may become a manufacturing rival to American and European countries. Just now there is little reason to become alarmed, but it is certain that the Japanese are actuated by a desire to promote the interests of their country and they will use every means at hand to hasten the completion of enterprises which they believe will assist them in developing the fields of mercantile activity and commercial manufactures. They have for some time been trying to imitate the electrical devices which American and European companies have introduced, but they have not as yet attained a position that would make them dangerous rivals in this particular field. But they are persistent and progressive, and American manufacturers of electrical apparatus would do well to take advantage of present conditions and reap the benefit of the market of to-day. In ten years Japan may be in position to build its own electrical machinery and supplies. In the meantime America should do the bulk of the business with the mikado's subjects.

IT is not at all complimentary to the civic pride of Buffalo to have the state board of railroad commissioners say officially that the town is not big enough to support more than one street railway company. Yet that is what the commissioners did when they extended their protection to the present company and refused to countenance competition. The decision of the commissioners denying the application of the Buffalo Traction company to build a new line of street railways does not seem to be approved by the people. The ground of the refusal is that the city already has railway facilities enough. Those who favored the new company say that if the city has the facilities, the existing monopoly certainly refuses to extend them to the public. Much dissatisfaction with the management is expressed by patrons of the old company, and it is believed lively competition might persuade the existing company to mend its ways. It is the general belief that the commission has stretched its authority to the utmost in refusing to let a new company lend an improving hand. The commission has subjected itself to the imputation that it is influenced by existing corporations against the public interest. This is not the first time that the commission has come to the rescue of companies with large political and financial influence when hard pressed.

THAT the proper lighting of streets has an important bearing upon the commercial and social progress of a city or village is clearly shown by the statistics presented by Mr. DeLand in his paper before the Northwestern Electrical association. While it may be true that there is a tendency on the part of young men born and raised in small towns to leave them for the greater attractions offered in large cities, it is also proven that the villages that have displayed a progressive spirit during the last 10 years have not only held their own in the matter of population, but they have attracted outsiders and brought in new industries, besides maintaining their normal growth. In many cases this improvement can be traced directly to the introduction of electric lighting into these towns. When care is taken to properly light the streets it is generally found that they are well paved and well kept. Then, too, the residents are found to be more progressive than their neighbors in villages that have dimly lighted streets. Their places of business are more inviting, their homes are more attractive, and there is an air of prosperity, comfort and culture pervading such a community that invariably attracts a most desirable class of homeseekers. It is well to consider these different aspects and impress their importance upon the men intrusted with the welfare of the town. Electric lighting companies in small communities cannot have too many favorable arguments on this subject to present for the consideration of local authorities.

IT has been several years since there has been an electrical exhibition of any consequence in the city of New York, and it may be said that there has never been an exhibition of an electrical nature in the metropolis that fittingly illustrated the condition of the art at the present time. When the Lenox exhibition was held it attracted great throngs, yet it could not be called a representative collection nor was it conducted upon a scale commensurate with the importance of the industry. The principal novelty was the use of incandescent lamps in decorative lighting, and in this particular the exhibition was certainly all that could be desired. The tower of light proved a great advertisement for incandescent electric lighting, and other features of the exhibition attracted attention to the work then in progress in several lines which have since been developed. But New York has never seen a first class electrical show such as can be given to-day, and it is safe to say that the people of that benighted city will open their eyes in astonishment when they behold the wonders that will be placed before them at the exhibition to be held next May in connection with the meeting of the National Electric Light association. The promoters of the project say that they are receiving much encouragement from electrical manufacturers in all parts of the country and that they can confidently predict that the electrical exposition will be the biggest and best show of the kind ever attempted. We earnestly hope that these expectations will be realized and that the people of New York will show appreciation of these efforts by liberally patronizing the exhibition.

COMPULSORY arbitration as a general rule does not appeal to the American spirit of independence and individual enterprise, but there are special cases where the general public is much more interested than the employer or the employes, and in many of these controversies the rights of the community seem to have been utterly disregarded. For such cases, it is contended, the only practical means of reaching a fair settlement is through the agency of some tribunal established by law for the purpose of adjusting the points under dispute. In its annual report just issued the New York State Board of Mediation and Arbitration renews its recommendation that railway companies, in the event of threatened strikes or lockouts, be compelled to submit the differences between them and their employes to arbitration. The board is careful to provide that the recommendation be limited in its application to corporations engaged in public service and not extended to private employers. It is argued that railway corporations are creatures of the state, receiving from it special privileges, and in consideration thereof assuming special obligations. It is not unreasonable to ask in return for these favors a constant and efficient service. In railway strikes, it is contended, the greatest sufferers are the people who are put to inconvenience, discomfort and loss of time by reason of the suspension of their accustomed transit facilities. Compulsory arbitration is suggested as the best protection against these evils, and it is believed that it would work to the advantage of railway companies and their employes as well as the general public. It is evident that the recommendation of the board has created a much more favorable impression this year than it did when first presented, and this may be attributed to the fact that the great street railway strikes have prepared the way for such a measure.

VIGOROUS opposition to the further extension of the numerous power transmission schemes at Niagara Falls may be expected henceforth from the commissioners of the New York State Reservation at Niagara Falls. In their annual report, just submitted to the Legislature, the commissioners say: "If the United States and Great Britain refuse to interpose, there is nothing to prevent the state of New York and the province of Ontario from drawing off so much water from the upper Niagara as to make the cataract practically disappear." If this statement of the case should prove fair and accurate, there is no doubt that further concessions to power companies would be denied and possibly those already granted might be revoked, but the reports of eminent hydraulic engineers who have carefully examined the problem indicate that the commissioners are unduly alarmed. Mr. Herschel's paper, which is cited in an article on this subject printed on another page, would indicate that there is absolutely no cause for alarm. The data upon which he bases his calculations is taken from no less an authority that the official government report of the Lake Survey. Assuming that the companies already operating at the Falls would utilize all the power which their franchises entitle them to, Mr. Herschel presents figures going to show that there would be no material reduction in the flow of the river. If this be true, it effectually disposes of the commissioners' protest. It would certainly be unjust at this time to impede the progress of industrial development at Niagara Falls without better grounds than the apprehension expressed in the report and the belief that the beauty of the natural scenery was threatened by the development of these power projects. The investment represented in these enterprises is of too great magnitude to be lightly regarded. Capital was interested in this work only after assurance had been given that the privileges obtained were secure to the companies to which they were granted. It is not believed that the Legislature will take any action that will jeopard existing enterprises, for while there is a strong sentiment throughout the state in favor of preserving the natural advantages of the Niagara reservation, there is also a sense of justice that will not permit the commissioners to sacrifice great financial interests without good cause, and it is not believed that the courts would sustain them in such a policy.

## Development of Artificial Illumination.[1]

By W. M. Stine.

I ask your attention this evening to a class of phenomena, which perhaps, more than any other, exercises a molding influence on material and mental life Doubtless few pause to consider the significance of the expression "light." The conception of light is taken to signify all that is excellent Were it possible for life to be sustained in the perpetual absence of light, how profoundly our thoughts and actions would be modified! Science plainly teaches that we are all children of the sun, and that we think and move and have our being in consequence of its energy-giving rays.

The story of artificial illumination begins with the very commencement of human history. The race could not have long been in existence before it felt the necessity for prolonging daylight. The story goes that about this time a genius arose who discovered fire This was kindled by the friction between pieces of wood rubbed briskly together. We next find that the primitive man noticed that a greasy stick burned better than the common wood. This gave rise to a vessel filled with animal oil and containing a porous wick. The collections of antiquities in the museums show that the ancients paid great attention to artificial lighting, as evidenced by the great number and varieties of their lamps. Many of these were crude and made of common baked clay; others were elaborately decorated and artistically designed. They were all constructed on the simplest principles. A vessel to contain the oil with an opening for a wick is about as simple a device for lighting as a pine splint. The oils employed were of various kinds—those extracted from animal fats and olive and almond oils. These were often scented with fragrant gums. But the ancients never rose to the dignity of mechanical contrivances, even so simple as those employed in the kerosene lamps of to-day. The only mechanical feature of their lamps was the wick. Oil of itself never burns; the wick in consequence of raising the oil by capillarity, feeds it to the flame in such small quantities that the heat may vaporize it. In this sense gas has been burned for light from the earliest times. Whether oils or solids, such as wood, are burned for light, the flame is always gaseous. The candle was doubtless an accidental discovery due to the fat solidifying about the wick in the containing vessel after the light had been put out.

In quite modern times the lamp underwent a slight improvement; the vessel was closed and the wick brought out through a tube, but the chimney was rarely used. A little later on we find the "fluid" lamps in use. This fluid was commonly a mixture of alcohol and turpentine, but was so explosive that many serious accidents caused it to fall into disuse. Immediately following this was the advent of petroleum or rock oil. The first use of petroleum was not for illumination but as a panacea for about all the human ills. It is singular that both electricity and coal oil should have at first received attention for their healing powers, and been the means in the hands of unscrupulous quacks for the perpetration of fraud. It looks as if the human race was more sick than anything else, and needed medicine rather than conveniences or facilities.

Only in the present century has artificial lighting received serious investigation. When it was realized that all flames were in reality burning gases, it was only natural that attempts should be made to drive off these gases by heat and store them for use. Here we mark the rise of the gas industry.

We may now ask, What constitutes the flame a source of light? A purely gaseous flame is scarcely luminous. To become a light-giver it must contain some solid or a mass of particles highly heated. In general a flame is a mass of burning gas yielding an intense heat, containing incidentally finely divided carbon which is heated to incandescence by the flame. Incandescence may be termed a form of molecular vibration, since it is only these ultimate little particles which can give rise to it. When the carbon molecules are highly heated they vibrate with such rapidity as to give rise to light waves. But the instructive part is that when so vibrating they do not move with one particular rapidity, but yield thousands of wave speeds. A very minute fraction of these lies within the range of visible waves, the greater part being too slow to affect the eye, and so are merely heat waves. In the serious study of our subject it may be remembered that visible heat rays have a frequency between the limits 400 to 800 billions per second. We speak more of carbon in this connection because it gives rise to a greater range of visible rays than any other form of matter. Common experience settled upon this long before science could offer an explanation for it. In point of fact about all artificial illumination has so far been effected by employing heated carbon derived from one source or another.

We may now inquire into the actual efficiency of different methods for illumination. Probably in no other instance has a greater waste of energy occurred. We have literally burned up whole present and antediluvian forests to get a little light. It matters not what form of lighting we consider, the story is the same. We can base our estimates only on very general ratios. In order to obtain one cent's worth of light it is necessary to burn from $2 to $5 worth of coal oil. What becomes of the great waste? It is spent in heating the air and surrounding objects. Were the eye as susceptible to the flame energy as the hand it would be destroyed by an attempt to see. About the same story may be told of the candle and the animal oil lamps. From the standpoint of economy no more absurd procedure can be imagined than the use of a flame for its light-producing qualities. From the standpoint of necessity the race has been compelled to do this or remain in darkness Illuminating gas is even more wasteful as a light source than oils and fats On the same basis one cent's worth of light is obtained only by burning from $3 to $6 and in some cases even $10 worth of gas. It needs no further argument to show that gas is more suitable for fuel than light.

The question may be asked, What is the gain in electric lighting over that by other means? In principle there is none All artificial light in use to day is still obtained from incandescent carbon The veriest savage obtains his from the same source So far as the means for rendering the carbon incandescent, electricity is the only rational and scientific method yet employed. Based on the percentage of total energy in the light source to that absorbed in directly producing light, the arc lamp is by far the best illuminant. In ordinary practice it converts about 15 per cent. of the energy expended upon it into light. The light energy of the incandescent lamp is usually considered about five per cent. of the total energy absorbed by it. In ordinary plant practice only about four per cent. of the total coal energy is delivered to the lamps. Reducing the light energy to a coal ratio, the arc lamp shows a light-producing efficiency of about six-tenths per cent.; the incandescent lamp of two-fifths per cent. This means that one cent's worth of light is obtained in the arc lamp for an expenditure of about $1.50 for coal; in the incandescent lamp for $5 for coal. For the utilization of the total energy the incandescent lamp is less efficient than the candle or the oil flame. Summing up the various illuminants and representing the energy necessary to produce one candle power in the gas jet by 100, the oil flame requires about 45; the incandescent lamp, three; the arc lamp, one. This has reference only to the energy consumed in the light source.

The most interesting aspect of our subject is to anticipate what may be gained in the future. The present wasteful and unsatisfactory conditions cannot obtain for many years longer. It is half the battle to know what to fight. We know pretty clearly what constitutes light—that it consists of transverse vibrations in the ether of certain rapidities. Further, it is known that electricity sets up in the ether movements that are similar to light waves, but these are as yet too slow. It only remains to devise the connecting link to make light mechanically possible. When an alternating or pulsating current passes over the wires its concentric lines of force swing in and out in time with its fluctuations. An ordinary alternator produces pulsations of a frequency of 120 to 260 per second. To produce light mechanically it would require a rapidity of pulsation of 400 to 800 millions of millions per second. The swiftest alternators are then two billion times too slow. Let us imagine that an ideal alternator could be speeded up to the required pulsations per second. The dynamo, wires, connections and lamps would become luminous, we would need no lamps at all. But it is doubtful if this would really occur. A line of force is but the ether in rotation, like a smoke ring. Whether these could drag the surrounding ether so as to set up true light waves is still an unsettled question. It might still be necessary to interpose some form of molecular disturbance to serve as the connecting link. Some rapid strides have been taken toward the accomplisment of what may be called the electrician's dream. We have gone as humble students to Nature's school and studied the processes and efficiencies of her marvelous lights. Before man ever dreamed of electricity the electric eel was electrocuting its prey in a truly modern fashion. The firefly and glowworm have for countless ages been emitting their lights. Only since we have come to realize that our light is accompanied by such enormous amounts of heat have we marveled that these creatures of light have not been consumed by their brilliant efforts. In these insects and worms we find illumination with an almost ideal efficiency; we have in them an example of cold light.

1. Abstract of lecture before the Chicago Academy of Sciences, January 30, 1896.

## Hamacek's Current Rectifier.

An American inventor, Adolph Hamacek of Sturgeon Bay, Wis., claims to have invented a device similar to the Pollak current rectifier now in use in Germany and described and illustrated in the Western Electrician of November 16, 1895, and January 18, 1896. In support of his claim Mr. Hamacek produces correspondence dated August 5, 1893, in which his invention and its application are thus alluded to:

In the case of alternating currents, where direct current is needed, I employ a synchronous motor for driving a pair of commutators whose segments correspond in number with the alternations of current and thus commutate it into direct current in the external circuit for commercial purposes, and return it back to its source again as alternating current through the same device. Another application assures self-regulation for any output of current to the full capacity of the generators, and is thus described by the inventor: I employ a compound wound constant potential direct current generator and apply my commutating device for converting the output into alternating current, and then distribute it by means of the transformer system. Thus we have a system which is adapted for long-distance lighting and is entirely self-regulating from one ampere to any capacity. It is also applicable with trolley circuits, or current employed for commercial lighting from street car lines. I employ direct current motors at convenient points to operate my commutating device, and these transform the direct current into alternating, and thence distribute through transformers.

## Storage Batteries in Central Stations.[1]

By Maurice Barnett

Those who were present at the convention of the Northwestern Electrical association a year ago will recall the paper on "Storage Batteries in Railway Plants" read by Herbert Condict, and will also recall that the paper in question did not excite any unusual discussion At the Cleveland convention of the National Electric Light association, Nelson W Perry reviewed the general aspects of the "Storage of Energy," and expressed what he considered to be the relative value of different forms of storage apparatus in a central station. So far as his remarks on the storage battery were concerned, there was very little concurrence of opinion with him and the discussion that was started drew, from a number of practical electrical engineers expressions that were favorable to the use of storage batteries in central stations. At the meeting of the American Institute of Electrical Engineers, held November 20, 1895, not fewer than four able papers were read on the subject of storage batteries, and the general consensus of opinion seemed to be that storage batteries, looked at either from the standpoint of first cost or general utility and economy in the station, were a decidedly valuable adjunct of central stations. Again, two years ago, there was only one important storage battery plant in use in a central station in the United States, and station managers were not seriously considering the installation of this form of accessory apparatus. During the last two years very large battery plants have been placed in Boston, in New York, and in Lawrence, Mass., by local Edison companies, while two battery installations have been made in Merrill, Wis., and Anaconda, Mont., in connection with railway power plants. Since the first installation was completed at Lawrence, the battery capacity has been doubled, and it is understood that the advisability of increasing the capacity of some of the other stations in the same way is conceded. Negotiations for storage battery plants for other central stations have been carried on for some time and will probably end in our seeing the number of existing battery plants very greatly increased.

What, it may be asked, has occasioned the change of attitude of electrical engineers and station managers toward the storage battery? The answer to this is:

First—Litigation no longer stands in the way of the use of any of the standard types of batteries.

Second—The application of special types of batteries to special kinds of work has resulted in a vastly improved performance of battery plants in meeting the exigencies of station work. This refers especially to the performance of a battery acting as a reservoir for storing the energy represented by the difference between the average and the maximum load, as a regulator of pressure on circuits subject to varying demands, and as a transformer utilizing high voltage charging currents and discharging at any lower voltage desired.

Third—It is generally recognized that plants part steam power and part storage battery are cheaper than an all steam power plant would be for the same work.

Fourth—The use of batteries in sub-stations frequently permits a saving in conductors between the central and the sub-station.

With regard to litigation it may be said that formerly when one bought a storage battery one assumed liability for a lawsuit at the same time. It is now generally known that this incubus on the storage battery business has been removed. One large company, ably managed, has obtained control of this business by securing to itself the right to manufacture, in the United States, storage batteries of all the important types heretofore developed. It has also obtained control of valuable foreign patents such as those covering the manufacture of the "chloride accumulator" and of the "Tudor" battery. The field has thus been cleared of litigation and those wishing to use storage batteries can do so without apprehending annoyance or loss in any way. This element of uncertainty was removed simultaneously with the dispelling of the prejudice against storage batteries, caused by their failure in certain applications for which, especially in their undeveloped form, they were notoriously unfit, a circumstance that has been of infinite value in removing the most important obstacle to the use of storage batteries in places where they were specially adapted.

Before taking up the practical side of this subject, as covered by the adaptability, performance and economy of storage batteries in central stations, it may be interesting to review a few typical battery plants here and abroad which have been installed to perform both regular and special functions. From the *Railway World* of November 12, 1895, the following paragraph is taken:

"The first accumulators used in connection with a railway power station were, so far as the writer can ascertain, those employed in the power plant of the railway lying between Zurich and Hirslanden, Switzerland, an account of which was published in the *Elektrotechnische Zeitschrift* of June 28, 1894. According to report, the dynamo delivers current under a constant load, the accumulators, being charged or discharged as load on the line is less or greater than the output of the dynamo. In this plant there were automatic means for cutting in and out of end cells to keep the voltage constant. Results showed that by means of the accumulators a saving was effected of 2.2 pounds of coal per hour, amounting to nearly a ton per day, or $2,500 a year. The cost of accumulators, installed complete with accessory apparatus, was $7,400. Allowing for interest and depreciation the battery paid for itself in four years by saving in coal bills alone. The saving was effected by reason of there being no necessity for keeping a second

1. Read before the Northwestern Electrical association, at Milwaukee, January 15-17, 1896

boiler and steam engine in reserve, and that by this arrangement the power plant ran at its highest efficiency. It was furthermore developed that the first cost of combined steam power and battery plant was less than the cost of total steam power plant would have been for the same work.

Two interesting battery applications were recently made abroad in the power plants of the Douglas-Laxey line and the Snaefell Mountain electric tramway, both in the Isle of Man. In the Douglas-Laxey line it requires a current of 150 amperes at 500 volts to carry a car up the 8½ per cent. gra e at a nine-mile rate. Before the battery was connected to the line the cars did not run very smoothly, owing to the variations produced by the starting of other cars. When the battery was connected to the line the cars ran with exceptional smoothness, the accumulators keeping the voltage

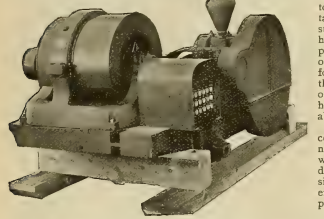

FIG. 1. ELECTRICALLY OPERATED MINING APPARATUS.—ELECTRIC MOTOR DRIVING HORIZONTAL PUMP.

steady and eliminating the variations due to sudden starting of cars.

The Mt. Snaefell battery plant consisted of 246 special cells of the chloride accumulator type. At 550 volts the battery furnished 176 amperes for three hours; 112 amperes for six hours; 84 amperes for nine hours, and 72 amperes for 12 hours. The battery was used in precisely the same way as that on the Douglas-Laxey line, with the exception that a special use was made of it at seasons of the year showing but little traffic. By agreement the line bound itself to run two cars a day each way every day of the year. As it would not pay to keep the power house in operation just for this load the practice was adopted of charging the battery once a week and allowing it to carry the whole load for the other six days.

Lastly, there is the Germantown plant. This battery installation is used to carry the peak of the load and also the minimum load. Speaking of this latter function, Charles M. Allen, the superintendent, has put himself on record as follows: "In the second place, we do not have sufficient day load to pay us, * * * and it is here the battery comes to our relief. Before we used the battery the loss on our day circuits was more discouraging. By the use of the battery we have wiped out this loss and can show some profit besides. We now shut down the machinery in the early morning, and the battery carries the entire load until nearly dark; then after midnight, while the load is light, but while we must still run our city lights, we charge the battery, and it is a fact noticed by our engineer, as shown on his reports, that he uses about the same quantity of coal on nights he does not charge the battery as when he does."

We can now take up in a general way the questions of adaptability, performance and economy of a storage battery in a central station, considering these in the following order: First, ability of battery to carry peak of load; second, economy of battery to carry minimum

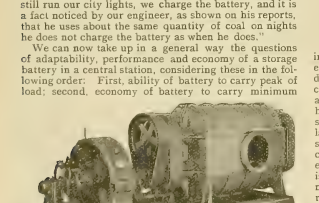

FIG. 2. ELECTRICALLY OPERATED MINING APPARATUS.—ELECTRIC MOTOR DRIVING ROOT BLOWER.

load, third ability of battery to regulate pressure, fourth, storage batteries in sub stations.

It is a fact which managers of central stations will readily admit that the maximum output of an electric lighting plant is limited to 1½ hours or at most to four hours a day. In designing a central station the engineer must consider several conditions. First, if he puts in complete steam power plant of most modern type to handle the maximum load, over half of the plant will be idle the greater part of the day, from which it will follow that the profits of lighting will be greatly reduced by large interest charges and heavy stand over losses in the boilers. Such a plant, besides being very expensive, has no reserve capacity in case of accident. To offset the question of large first cost it has been proposed to introduce the best type of economical machinery to handle the average output with some less expensive apparatus to take care of the overload. For the latter work Mr. Perry has proposed gas engines to drive extra dynamos. Such a plant, while avoiding the stand-over losses to which a boiler plant is subject and showing smaller interest charges, is open to the objection that amortisation expenses of cheap machinery, not to speak of loss in efficiency, counterbalance the saving in interest. Nor has such a plant any reserve capacity in case of accident. Mr. Perry's suggestion of gas engines would be valuable, were it not for the fact that every failure to ignite would appreciably alter the speed of the dynamos, as gas engines cannot maintain their speed when obliged to make two revolutions on a single explosion. As a matter of fact in gas engine plants a storage battery is considered almost absolutely essential as a regulator and as a reserve against breakdown. Lastly there is the combination of a steam power plant to handle the average output and a storage battery to take care of the overload. Storage batteries of central station type can be installed for this work for about one-half what a steam power plant would cost, making a plant half steam power and half storage battery cost only three-quarters what an all steam power plant would for the same work. C. L. Edgar, general manager of the Boston Edison Illuminating company, which is the owner of the largest storage battery plant in the world, has put himself on record as to the accuracy of the above figures.

A question that arises here is as to the maintenance cost of such a battery. Generally speaking it should not exceed that of direct generating machinery. In work of this kind, therefore, the storage battery has undoubted economic value as it suggests the way of designing a central station that will be only moderately expensive and which will be safeguarded against stoppage arising from accident to the generating machinery.

Coming now to the question of using storage batteries to carry the minimum load, it may be said that opinion is divided on this point. Abroad, where the motor load is insignificant, the minimum demand for power lasts for half a day. It is thus possible to get along with a single shift of men and something is also saved by drawing the fires, banking the boilers or other practice when it is not

ARTISTIC DESIGN FOR ARC LAMP.

intended to run the plant—and it is considered more economical to let the battery take care of the minimum demand than to handle it with the direct minimum machinery. In this country the motor load is very important and the minimum load lasts only from four to six hours a day. A whole shift of men cannot thus be saved. Experiments have been tried in Boston on a large scale with a view to ascertaining the value of a storage battery in this connection. As yet no definite conclusion has been reached on this point. Undoubtedly there are numerous cases where the minimum load is small and lasts for half a day at least, making it economical to use a battery. The Germantown plan already referred to is a case in point where most satisfactory results are obtained by using a battery in such a connection.

One of the most important and valuable functions of a storage battery in a central station is as a regulator of pressure. To anyone who watches the variations in the voltage and amperage of generators running with and without storage batteries, conviction will soon come that the voltage varies perceptibly less when a battery is arranged in parallel with the generator than when it is not. When a shunt-wound dynamo, such as are used in central stations, is running alone, any increase in ampere output will be attended by a fall in voltage. When, on the other hand, a battery is combined with the dynamo, the moment the pressure falls from a large demand for current on the line the battery begins to discharge and thus augments the output of the dynamo. In other words the battery acts as a reservoir. When the load on the line is small the battery is charged, when the load becomes heavy the battery begins to discharge, and in so doing performs a doubly valuable function. In the first place it saves the generating machinery from strain, and, secondly, by keeping the pressure constant makes possible a much higher efficiency both in the station and on the line. Mr. Edgar has said that if a steam plant and a battery plant were on a par in all other respects, he would personally feel very much inclined to install a battery plant for the above reason alone.

Lastly, we come to the question of the use of storage batteries in sub-stations. Just imagine a city which has spread out irregularly. At some distance from the central station it may happen that the population is large and that considerable current will be required to furnish adequate light. If the situation is such that it is cheaper to furnish light from the central station, than to operate a small power plant as a sub-station, the former will be done. The consequence of this will be shown in very heavy losses in the line owing to large currents transmitted; and secondly, there will be heavy interest charges for very large conductors. If, on the other hand, a storage battery sub-station were located in the center of this suburb the following economies would be gained.

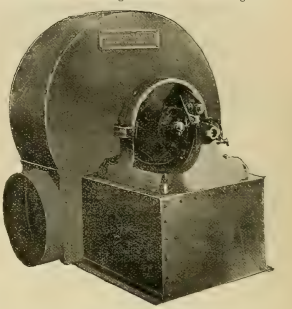

FIG. 3. ELECTRICALLY OPERATED MINING APPARATUS.—ELECTRIC MOTOR DRIVING 60-INCH EXHAUST FAN.

In the first place much smaller conductors would be employed, resulting in diminished interest charges; and secondly, a high-tension current would be used in transmission, by which losses on the line would be lessened. These economies are brought about by the ability of the battery to act as a "transformer." In other words the battery may be charged in series with a high-tension current and discharged in multiple, bringing the pressure at the sub-station down to requirements.

On the other hand, a battery may be charged in multiple and discharged in series, by which it will be possible to get along with one dynamo instead of two or more in series. Owing to the flexibility of storage batteries they are splendidly adapted to working on a three-wire or a five-wire system.

There is one point that has not, thus far, been touched upon, namely, the local consumption in a station consisting of both generators and batteries. The use of storage batteries is sometimes objected to on the ground that there is a loss of 15 to 20 per cent. of the watts generated while the battery is being charged. Perhaps we can do no better than by quoting Mr. Edgar again: "The watts lost," says Mr. Edgar, "by the inefficiency of the battery are made up more than four-fold by the better economy of the steam plant. We have taken typical winter days and figured out exactly the cost of running our system with the battery and without, and have proved that the actual coal consumed with the battery is a material amount less than without it."

To recapitulate, storage batteries are valuable in central stations on account of the three-fold function they perform as reservoirs of energy, regulators of pressure,

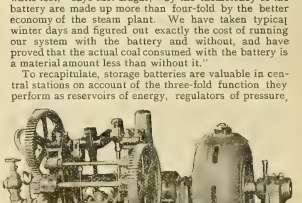

FIG. 4. ELECTRICALLY OPERATED MINING APPARATUS.—MULTIPHASE MOTOR DRIVING VERTICAL PUMP.

and transformers of high to low or low to high tension currents. In performing these functions they make possible lower first cost in main central station and lower first cost for conductors between this and the sub-stations where batteries may be installed. They are, further, valuable in saving the power and generating machinery from strain and in effecting economy by introducing the factor of high efficiency in the station and on the line.

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The *Brooklyn Manufacturer* is a new monthly journal started as the especial advocate and exponent of the manufacturers of Brooklyn and Long Island. The first number is a creditable one.

## Dickinson Electric Lamp-letters.

The utility of the new incandescent lamps for electric light advertising which are shown by the accompanying cut is at once apparent, and the new lamps will undoubtedly be in great demand for sign lighting. In making, the bulbs are blown with broadly flattened ends, and on this surface a coating of japan is applied which forms a black ground to the letter, the lamp being frosted so that only a diffusion and not a glare of light is present, and of course the only thing that confronts the eye is the letter of the alphabet thus made so prominent. Each lamp is a letter in itself, and any letters or combination of letters may be purchased, so that every merchant, with appropriately arranged sockets in a frame or otherwise, may become his own sign maker

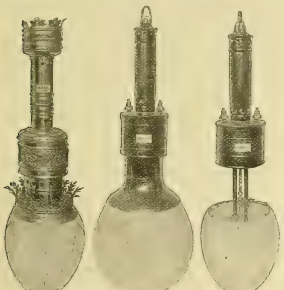
DICKINSON ELECTRIC LAMP-LETTERS.

and change his announcement as often as desired. The letters are, of course, interchangeable, and there is no limit to their usefulness. The idea is simple and effective and should prove very popular. The device is known as the Alpha and is exploited by the Dickinson Electric Supply company, Tract building, New York city.

## Ajax Arc Lamps.

As arc lamps are becoming more generally used on low potential circuits, the increased demand for such lamps has stimulated inventive minds to great activity in the field of developing a lamp that will be electrically efficient, mechanically simple, neat in artistic design, and capable of filling the exacting demands of a critical public in the point of quality of light and steadiness of burning, and at the same time meeting the commercial requirements at a low first cost.

One of the recent additions to the already long list of lamps claiming more or less merit in this particular line is the Ajax lamp, manufactured by C. S. Van Nuis of 136 Liberty Street, New York, of which three designs are herewith illustrated. Fig. 1 shows an ornamental brass lamp with opal globe and rich cast-brass corona; Fig. 2 represents a black japan case, with round globe and spark arrester, as arranged for out-door use, the resistance coils being mounted upon porcelain insulators, on a detachable frame within the tube at the top of the lamp, making the lamp complete in itself and presenting



FIGS. 1, 2 AND 3. AJAX ARC LAMPS.

a compact and neat appearance, while Fig. 3 depicts practically the same lamp as Fig. 2, with the spark arrester removed, showing the type of globe-holder adopted for use with these lamps. This globe-holder is one of many ingenious devices that enter into the make-up of the Ajax lamp, contributing toward a serviceable and artistic whole.

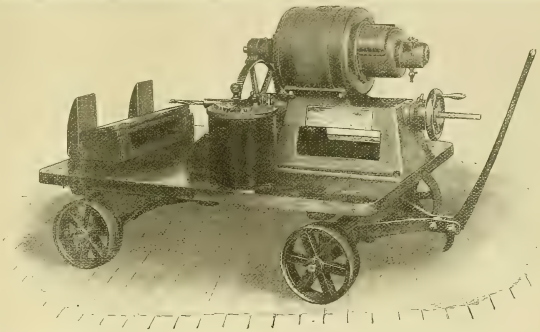
Among the points of superiority claimed for the Ajax lamp are the absence of complicated parts and mechanism. The regulation is accomplished by a single magnet, which attracts an armature through a long arc and controls at the further end of a rock-shaft a triple movement which acts upon the rack or upper carbon rod. This triple movement is accomplished in an ingenious manner by a simply constructed movement frame and brake-wheel, which is said to admit of the lamp striking approximately a normal arc and maintaining a uniform candle power throughout the life of the carbons. Where one movement alone controls the regulation of a lamp, it may be said that maximum mechanical simplicity has been attained, but it is questionable if any one movement, either electrical or mechanical, can be applied directly to the upper carbon of a lamp, so as to obtain an accurate adjustment of the arc under the varying conditions of a practical working electric circuit. So far as the simplifying of the controlling movement to a single unit is concerned, the designer of the Ajax lamp has reached that goal, but he has deemed it advisable to introduce the more sensitive triple movement into the feed mechanism in order to insure a more gradual and delicate adjustment of the arc than could be obtained by applying a simple magnet movement direct.

Fluctuations of electrical potential are fatal to close regulation in arc lamps governed by too crude a movement between governing magnet and the arc, and it is claimed for the Ajax lamp that a considerable variation in the governing magnet, due to a sudden rise or fall of potential of the circuit supplying the lamps, will effect the arc but slightly, because such sudden variation is largely compensated for by the three-fold movement above described.

It would appear, therefore, that with a closely regulated circuit, the Ajax lamp would feed by inappreciable increments, giving steady light, and that with an ever varying potential these fluctuations would be minimized at the arc.

## New Storey Portable Electric Drill.

The general adoption of electricity in machine shops and factories favors the use of a compact and efficient port-



NEW STOREY PORTABLE ELECTRIC DRILL.

able electric drill such as that placed on the market by the Storey Motor & Tool company of Philadelphia and illustrated in the accompanying cut. This machine is adapted for drilling pig-iron and copper for test work; drilling rails and for various other kinds of work. Owing to the type of the motor, which is entirely enclosed, it is suitable not only for indoor work, but can also be used for outside purposes without requiring any specially arranged covering for its protection. The outfit complete consists of motor and drill combined, together with a regulating rheostat for obtaining any desired speed, and a drum with 100 feet of flexible cord, all mounted on a truck, with or without a rack for holding material to be drilled. These machines drill in sizes up to 1½ inches in steel and two inches in cast-iron, and are furnished with both automatic and hand feeds These drills can also be placed on a table or in any stationary position and will cover a large range of work of different classes. As an illustration, an application may be mentioned where two of these drills are mounted on bed-plates, one at each end of a large callender roll, drilling two holes in flanges at the same time and tapping them in the same operation, before the roll is moved. Another adaptation of this drill is where it is fitted with a telescoping shaft and is used in yards for drilling holes in the construction of switches and crossings for street car and railroad work.

The Philadelphia Edison Electric Light company's annual report shows a profit of $200,223, according to newspaper report.

## Artistic Design for Arc Lamps.

Among the improvements that have marked the development of arc lighting none have been so apparent to the public as those affecting the appearance of the lamps. In the early days a rudely constructed frame was all that was demanded by the public, and while companies were working out improvements in features of construction and operation they had little time to devote to the appearance of the lamp. It is not to be wondered then that for a time many of the early lamps were positively ugly in appearance. But wonderful changes have been made of late years. At the present time very attractive lamps can be seen in every large city, and in many places the special styles adopted for ornamental purposes have been of really artistic design. An idea of the importance which manufacturers attach to the attractive appearance of their lamps can be gathered from the fact that one company which has made a special feature of artistically designed lamps has secured a patent on one style. The accompanying cut, which is taken from the records of the Patent Office, shows a lamp designed by Thomas E. Adams of Cleveland, which has just been patented. This lamp, it will be remembered, was described and illustrated in this journal, October 19, 1895, and is made by the Adams-Bagnall company of Cleveland.

## Electrically Operated Mining Apparatus.

In the cuts on page 68 are shown some special forms of electric motors designed for operating mining machines. Fig. 1 shows a 6½ inch by 8 inch horizontal triplex pump, directly driven by a 10 horse power four-pole slow-speed motor through two reduction gears, the entire combination on the same base being mounted on a truck for ready transportation from place to place in the mine. The motor is controlled by a rheostat set at the side and, like the motor, housed in with a sheet-iron cover. Fig. 2 shows a No. 4 Root blower driven by a four-pole slow-speed motor of 15 horse power capacity and mounted on a common base frame. Fig. 3 is a 60 inch steel plate exhaust fan operated by a 2½ horse power four-pole motor. The fan makes 480 revolutions per minute and has a capacity of 8,300 cubic feet of air per minute at three-quarter ounce pressure.

These motors, built by the General Electric company, are recent developments designed for use on direct current circuits. They are compactly built and admit of direct combination with machinery without increasing the space occupied to any great extent. Although reduction of speed must necessarily imply increase of weight, it is claimed that in this case it is amply compensated for by economy of material effected by the adoption of the four-pole type. The frames and fields are of special soft cast steel, which, possessing high magnetic permeability, allows of the construction of a motor lighter than other motors of the same output at higher speed. The armatures are thoroughly ventilated, and the windings of copper wire, first formed and insulated, are embedded in slots in the armature core, and bound down securely on the projecting flange of the armature spider. The coils can be easily removed and replaced; the insulation is the result of years of experience. The machines are sparkless and the load can be varied from nothing to full load without

the necessity of shifting the brushes. Precautions are taken to prevent any tendency on the part of the bearings to get out of alignment, and proper contact of brushes with the commutator is insured by special construction of the brush-holders. Another combination introducing the multiphase motor for use on alternating current circuits, whether monocyclic or multiphase, is shown in Fig. 4, illustrating a triplex vertical single acting pump, directly connected to a 220 volt, 60 cycle, 10 horse power multiphase motor. This type of motor, aside from its compactness, which allows of its erection in a restricted space, has the additional advantage of being absolutely without brushes, commutator or moving wires. The special features claimed for it are that it requires no attention and may be stopped and started under full load or no load; in fact, that it has all the advantages of the best type of direct current motor with better regulation and without any of the disadvantages which the presence of commutators, brushes and a wire wound armature may develop.

## Electric Motors for Cable Drums in Kansas City Railway Work.

James R. Chapman, electrical superintendent of the Yerkes street railway system in Chicago, was in Kansas City recently in consultation with the officials of the Metropolitan company in regard to running the machinery of the various cable line power houses by electricity furnished from the central electric power house which it is the intention of the company to build this spring in Riverview.

Mr. Chapman stated that this scheme has already been tried in some cable houses and has been found not only to work well, but to effect a great saving, as several lines of cable can thus be run by power furnished from one central plant. Mr. Chapman discussed the subject with President C. F. Morse, General Manager Walton H. Holmes and General Superintendent Conway F. Holmes, and they were much impressed by the facts and figures given them. General Manager Walton H. Holmes said that the Metropolitan company was inclined to look very favorably on the plan and that in all likelihood it would be tried as soon as the Riverview power house is completed.

Mr. Chapman has been retained as consulting engineer for the electrical part of the Metropolitan system and in a short time he will make another visit to Kansas City, at which time the question now under consideration will be fully decided.

## St. Louis Electrical Exchange.

The fourth annual banquet of the St. Louis Electrical Exchange was held at Koerner's Café on Washington avenue, St. Louis, Saturday night, January 25th. The exchange is composed of construction men and supply dealers.

The president, Edward T. Cooke, gave an address in which he set forth the disadvantageous position of construction men, in that they not only have to compete closely with each other in making bids on work, but are frequently annoyed and sometimes handicapped by supply dealers who retail goods direct to the consumer at about wholesale prices. This state of affairs has caused the exchange to consider the matter of organizing a national exchange to be composed of local exchanges of all the larger cities throughout the United States.

The secretary, Otto Kuhns, read a number of articles on the same subject, in which it was shown that other construction industries maintained local and national associations with great advantage to themselves and that the electrical construction industry will be compelled to do likewise for mutual protection.

The St. Louis exchange intends to initiate such a movement at once by sending out to all construction concerns inquiries on the subject of a national exchange.

An excellent menu was served, and toasts were responded to by George J. Fercival, ex-president of the exchange, Otto Kuhns, A. E. Boeschenstein, E. Ruebel, Gus Sachs, Jacob Ehrlich, J. H. Fenton, J. Dillon, Charles J. Sutter, Paul Cable and Charles Stagl.

## Standard Electric Company's Affairs.

At a meeting of the creditors of the Standard Electric company, held on January 27th, the following named committee was appointed: F. E. Donohoe, American Electrical Works; E. C. Ferguson, Erie City Iron Works; E. L. Barr, Ansonia Electrical company; H. R. Hixson, Simplex Electrical company; F. S. Terry, Lalor company. The committee will represent the whole body of creditors in investigating the affairs of the company, and will make a report. Mr. Hixson is the secretary.

On February 1st the company, by its treasurer, E. E. Crepin, issued the following statement:

On account of some misunderstanding various rumors are being circulated concerning the affairs of this company, which are detrimental to the officers of this company, and are not in accordance with the exact situation, we deem it best to make the following statement:

The general depression in business for some time past so affected the affairs of this company that the board of directors decided to make a general assignment. Accordingly, on January 16th last, an assignment was made for the benefit of all creditors.

The assignee has just completed and filed an inventory, which shows as follows:

| | |
|---|---|
| Merchandise and manufactured machinery | $ 94,490.27 |
| Machinery and tools | 32,684.64 |
| Bills receivable | 5,449.21 |
| Accounts receivable | 73,393.45 |
| Office furniture | 75.00 |
| Real estate | 60,400.00 |
| Stocks and bonds | 5,750.00 |
| Total assets | $272,242.57 |
| The liabilities are | 100,142.97 |
| Total assets over liabilities | $172,099.60 |

In this inventory are not included patents and patterns, which represent a considerable amount upon the books of the company, and which are of some value to a going concern.

We are satisfied that the estimate of the assets as above stated is a fair one, and that all creditors can be paid therefrom in full, without expense of any kind on their part.

The impression has arisen that there is, or was, some especial reason for making an assignment other than that which appears, and that with the assets as stated we should have continued in business. Our answer to this is that owing to the stringency of the times, difficulty of making collections, and inability to meet our obligations as they became due, it was thought best to make an assignment as stated.

Our stockholders hope to realize something upon their investment after all creditors are paid in full. The officers of the company are aiding the assignee under order of court, in realizing the full value of all assets. We ask the hearty coöperation of each of our creditors to this end.

By sending a verified statement of your account to the assignee it will receive all necessary attention without expense to you

Any further information will be gladly given.

## Engineers' Club of St. Louis.

At the meeting of the Engineers' Club of St. Louis on January 22d, Lieutenant E. J. Spencer read a paper on "Underground Electrical Service," giving the results of the wide study and varied experience which the speaker has had in work of this character in different parts of the country. He reviewed the historical features of the subject, explaining the work done both at home and abroad, the difficulties which had been met and how they had been overcome. The speaker explained the work which had been done in New York, Philadelphia, Boston, Chicago and elsewhere, and regretted the fact that St. Louis was moving so slowly. He stated that there was no city east of St. Louis of 150,000 inhabitants or more which did not have its wires underground in the business districts. He showed a number of samples of cables of different types and for a wide variety of purposes. Messrs. Moore, Bryan and Flad participated in the discussion

## Assignment of the Gates Electric Manufacturing Company.

On January 31st the Gates Electric Manufacturing company, having an office at 1140 Monadnock building, Chicago, and a factory on the fourth floor of a building at Harrison and Clinton streets, made a voluntary assignment to the Chicago Title & Trust company. The creditors are principally employes, who have not been paid, it is said, for three weeks past. Eastern houses are also creditors to a limited extent. Liabilities are estimated at $10,000 and assets nominally at $17,000, consisting of machinery, stock, tools and accounts receivable.

The annual statement of the City & Suburban Railway company of Baltimore shows an extremely satisfactory condition, the increase of receipts being in round figures $200,000 more than those of 1894. The gross receipts during that year were about $3,900,000, which included the Lake Roland system with the City & Suburban. Last year the gross receipts were $4,150,000 in round numbers. The City & Suburban Railway company has completed arrangements for its extension to Sparrow's Point which will mean a lengthening of the road in that direction of 15 miles. Right of way has been secured and work will be begun at the first indication of favorable weather and the work pushed through for the summer traffic

# CORRESPONDENCE.

## New York Notes.

NEW YORK, February 1.—The movement for an effective organization of the electric lighting companies of the state, begun in December last, is attracting attention. The New York State Electric Lighting association has been formed, and Charles R. Huntley of Buffalo is the president. The association is organized, according to its constitution, "to furnish reliable information concerning the electric light, heat and power industries and to foster and promote the common interests of its members." All the companies in the important cities of the state will be invited to join. A gentleman in the interior of the state interested in the new association gives this explanation of its objects: "In Pennsylvania and in Massachusetts there are state associations through whose efforts state commissions have been established similar to the railroad commission in New York, to which applications for franchises have to go. This prevents the striking that is going on continually in all cities where valuable franchises are held, by which one company secures a franchise under which it never intends to do business, and uses that franchise to force the company already operating a plant to give up a portion of its stock. It is this sort of thing that the state association is going to prevent if it can. All electric lighting companies from New York to Buffalo will stand together to put a stop to striking. The association is in no sense a combine. The meetings will probably be largely devoted to a discussion of the teachings of electrical business. The furtherance of our common interests by every legitimate means is, of course, contemplated. A state electric commission in New York would be of advantage to the electric companies and to the state. That commission would investigate every new company formed and consider every franchise granted by local authorities. Its influence would be altogether good."

At the hearing last week in the Supreme Court on the application of the elevated railroad companies of Brooklyn for an injunction to restrain the city from selling their property for arrears of taxes, the main argument hinged on the alleged breach of faith of the city authorities in allowing the surface roads to be operated by electricity, and thus introducing surface rapid transit. It was declared that the operation of the trolley cars had proved a ruinous competition, and reduced the earning capacity of the elevated roads 50 per cent. The unpaid taxes on the Brooklyn elevated road for 1893 amount to $100,000 and on the Kings County Elevated $70,000.

The Edison Electric Illuminating company of New York reports that for the year ended December 31st the gross earnings were $1,859,721, an increase of $372,810 as compared with the corresponding period of the previous year, and net $911,758, an increase of $122,292 The report of the Edison Electric Illuminating company of Brooklyn for the year shows: Gross receipts $621,149, increase $200,075; net earnings $237,442, increase $50,566; total income $267,349, increase $43,934; balance after interest $233,599, increase $35,184; surplus after dividends $31,099, increase $1,434. The American District Telegraph company of New York shows a net profit of $80,634 for the year, an increase of $12,429 over 1894.

A certificate of the incorporation of the Brooklyn Rapid Transit company, with a capital of $20,000,000, has been filed with the county clerk in Brooklyn. The new company will succeed the Long Island Traction company in the ownership of the Brooklyn Heights road and in the control of the Brooklyn City and the Suburban companies.

Charles H. Hines, superintendent of the electric department of the Flatbush gasworks, while attempting to start a dynamo placed his hand on a partially unprotected switch while standing with his shoe heel on an iron substance. He received a shock from an alternating current estimated to have a potential of 2,000 volts. He fell unconscious and was removed to his home, where, after several hours, he showed signs of recovery. He remained in a partially paralyzed condition all day, but the numbness caused by the shock gradually wore off, and he recovered

W. F. O.

## Northwestern Notations.

MINNEAPOLIS, January 31.—Geo F Dickinson of Oshkosh, Wis., committed suicide this week. He was an enthusiastic supporter of the new electric railway project there and supported it with his money It is believed that he got into financial straits through this, and committed the deed because he despaired of getting on his feet again.

It is announced that the Hartman General Electric com-

pany has bought a controlling interest in the Gas & Water company at Duluth, Minn., but as the latter is held in no enviable regard by Duluth citizens, owing to the recent disclosures on the water supply, and an election is pending, some have suspicions that the transfer was for political purposes only.

C. H. Miller and others are considering putting in an electric light plant at St. Ansgar, Ia.

Wire Inspector Pillsbury, in Minneapolis, has ordered the electric companies which maintain wires over the roofs of buildings in the down-town district to fasten them at least seven feet above the roofs.

J. T. Boustead, an electrician from Minneapolis, has examined the Brainerd Traction, Light & Power company's plant at Brainerd, Minn , and reports that it requires a general overhauling and improvement

F. W. Oakley of Madison, Wis., and S. T. Norvell, manager of the Rapid Transit company at Superior, Wis., have been appointed receivers for the corporation, on application of the Central Trust company of New York. It is understood that the company has a bonded liability of $200,000.

The Board of Public Works of St. Paul has prepared specifications for lighting the city by electricity, to supplant the present equipment of gas, and figures that 570 arcs of 2,000 candle power will do the work. The board does not recommend a municipal plant unless the bids for lighting the city should prove too high. The board divide the city into four districts to permit firms with private plants bidding for the lighting in their districts. Estimates were taken on the basis of overhead wiring in the suburban districts as well as on underground. The president of the gas light company is an interview criticizes the report roundly and hints that should the city attempt to use overhead wires in the prohibited district a suit for damages would follow

The project of an electric line from Minneapolis to Lake Minnetonka, which has bobbed up every spring since electricity first went into use in the city, has arrived again. This time it is connection with the Minneapolis & St. Louis railroad, which is alleged to have built its tracks with a view to equipping them for electricity. The rumor has it that the trolley system will not be used. A fleet of electric launches for the lake is also promised.

H. J. Burton of Minneapolis, a yachting enthusiast, is considering equipping a sailboat with a storage battery and motor, which would make yachting an almost perfect sport. He has a complete plant at his country home at Deephaven, Lake Minnetonka, and may equip his boat in that fashion this summer.

Rockwell City, Ia., will vote on the question of an electric light plant.

It is understood that the Electric Light & Power company of Fort Dodge, Ia., will begin work in the early spring on an electric line.

C. M. Fleek of Janesville, Wis., was swindled out of $100 by a bogus telegram from Baltimore to his son in Janesville, signed with his own name, and says he will sue the telegraph company for the amount lost.

A. L. Smith, representing a reorganization committee, bought the plant of the Appleton Edison Electric Light company of Appleton, Wis., at sheriff's sale.

The City Council of Minneapolis has requested the street railway company to consider the matter of an extension of the Camden Place line to the workhouse, as petitioned by North Side citizens.

William H. Doane of Westerly, R. I., L. H. Biglow of New York city and E. P. Griswold of Chicago intervene in the case of the Old Colony Trust company against the Dubuque Light & Traction company of Dubuque, Iowa, and allege that the former purchased the Eighth street line through fraudulent representations, and ask that the sale be set aside and the property restored to them, free from lien or claim by the Old Colony Trust company. C.

## PERSONAL.

Cable advices from London state that Sir John Pender, known as "the cable king," from his extensive connection with submarine telegraphs in all parts of the world, is dangerously ill.

Max A. Berg has resigned the management of the Chicago office of the Ohio Brass company to accept a responsible position at the home office of the company at Mansfield, O. The Chicago office will be continued in charge of J. H. McGill.

## ELECTRIC LIGHTING.

Harry S. Lafferty has been granted au electric light franchise by the City Council of Bedford, Iowa. Persons desiring information may address him at Alexis, Ill Mr Lafferty will put in a 45 light arc machine and a 1,500 light incandescent dynamo

The city of St Joseph, Mich , contemplates the erection of a municipal lighting plant

The Fort Wayne company has secured the contract for the plant at London, O , for $5,000 50

A fire at a Stamford, Conn , hotel, by which a three year-old boy was burned to death, came from a napkin which had been placed on an electric light to shield the child's eyes from the glare An experiment since made with a similar lamp shows that the heat was sufficient to cause the cloth to take fire

## ELECTRIC RAILWAYS.

The Ottawa, Ont , Electric Railway company received in revenue for the seven months ended December 31, 1895, $128,173.98 The total expenses were $73,983 43 leaving net profits of $54,190 50, or 6.05 per cent for the seven months on the paid-up capital stock The passengers carried for the period numbered 2,843,175

At a special meeting of the Akron, O , Street Railway & Illuminating company it was decided to double the present capacity of both branches of the industry. In order to do this new electric light and power houses will be built at once. A street car barn is to be constructed in East Akron and many new cars will be purchased

The Dallas, Tex , City Street Railway company has been reorganized with a capital stock of $350,000. The new company assumes control of all the street railway property formerly owned and operated by the Dallas Consolidated Traction Railway company. The company is chartered under the laws of Texas and has a number of stockholders outside the state. It is the purpose of the new company to put all the lines under its supervision in first-class shape, and, as soon as practicable, to place electric cars on Ervay and Akard streets and McKinney avenue.

## TRADE NEWS.

The Correspondence School of Technology of Cleveland, O., announces complete courses in civil and mechanical engineering, including steam and electrical engineering. Thorough training in advanced mathematics is given.

W. H. McKinlock, president of the Metropolitan Electric company, has returned from the East, where he has been getting some new agencies and calling upon old friends. The prospects for business for 1896, he states, are very bright.

In addition to having the largest gear cutting equipment in the world, the R. D. Nuttall company claims to turn out some of the finest machine work in the country, including such work as sewing machines, geometrical lathes, etc., and the company has a standing in these lines equal to its reputation in the electrical trade.

F. M. Bernardin has been appointed sales agent in the western states for the Dorner & Dutton Manufacturing company of Cleveland, manufacturer of gears, pinions, sprocket and other electric railway specialties. Mr Bernardin, whose office is at 315 Keith & Perry building, Kansas City, Mo., reports large sales of electric railway supplies during January.

The business of the reorganized Ansonia Electrical company of Ansonia, Conn , is being pushed by Manager Wallace. This company controls the well-known Shield brand moisture-proof insulated wire, "the highest quality of braided insulation," Hercules trolley wire and a complete line of house goods. The officers are: Franklin Farrel, president; Thomas Wallace, Jr., vice-president and manager; Franklin B. Platt, secretary; L. F. Anschutz, treasurer.

The Northwest Engineering company, 150 East Fifth street, St. Paul, Minn., reports a most gratifying increase in business. This concern is one of the most prosperous of the northwestern electrical enterprises, and it has recently entered the telephone field. The company is manufacturing telephones, believing that telephone buyers prefer to purchase direct from the factory. General Manager J. J. Schoenleber is pushing the business, assisted by J. H. Whitacker. Both Mr. Schoenleber and Mr. Whitacker are men of wide experience in the electrical business, and their present success is well deserved. As far as the company's telephone business is concerned, although this is only one of its branches, the supply business being the main portion, the concern has already shipped instruments all over the country, and the demand is increasing in a manner that indicates a very bright future for the telephone department

The Hess Storage Battery company of Springfield, O., has issued an attractive prospectus The distinguishing feature of the Hess battery is the permanency of its plates. The electrodes are asserted to be practically perpetual; they are so protected that disintegration is said to be impossible, and the method of protection is such that it interferes in no way with electrolytic or chemical action. The fundamental principle of construction is the use of the double electrode. Instead of pasting the active material upon a single lead plate, exposed directly to the action of the electrolyte, in the Hess battery the plates (composed of lead) are in pairs, forming what may be termed a double electrode, or conducting body, for the active material, which is interposed between the two plates. These plates are perforated and are entirely covered with an insulating material, excepting portions of the inner faces of the plate. The perforations of the plates are filled with a non conducting material of great porosity, composed of quartz sand, the particles of which are held together by asphalt The Hess cells have been tested by Houston & Kennelly, who report them to be well adapted for electric lighting purposes.

At the annual meeting of the Standard Underground Cable company at Pittsburg, the following named gentlemen (all of Pittsburg) were re-elected as directors: George Westinghouse, Jr., Robert Pitcairn, Mark W Watson, J W Dalzell, George B Hill, John B Jackson, James H Willock, John Moorhead, Jr, Joseph W Marsh The report of the board of directors showed a total business of nearly $1,000,000 for the year 1895 During the year three quarterly dividends of 1½ per cent each and one of two per cent were declared, and the remainder of the earnings carried into surplus account, which now stands at $436,869, notwithstanding the fact that at the beginning of the year $100,000 was charged off on patent account and $47,000 on account of bad debts, doubtful assets, etc, arising in the first 12 years of the company's existence. Early in the year 1895 a large two-story and basement building (Factory C) was completed and occupied, adjacent to the company's other factories at the corner of Sixteenth street and the Allegheny Valley railroad, in the heart of the manufacturing district of Pittsburg, and Factory B was remodeled into a three-story and basement building, 55 by 117 feet, of first-class slow-burning construction. The original factory (A) is a large four-story and basement building, and all three factories were equipped during the year with automatic sprinklers, thus greatly reducing insurance premiums, and making a serious fire practically impossible, and so obviating any danger of inability to fill orders on account of fire—an extremely important consideration, where, as in the case of this company, the orders have kept the factory running night and day throughout most of the year. The company carried over into January a large amount of unfilled orders. The orders booked in January have been spread over a wide extent of territory, and the prospects for a large business in 1896 are considered good. This company was the pioneer in the underground cable business, having been organized in 1882, and was for a number of years the only distinctively underground cable company in the United States. For a number of years past it has also been doing a large business in insulated wire of various kinds for overhead use. During the period of its existence, its products have been installed and successfully operated in every state in the Union, and in many foreign countries, notably Venezuela, Brazil and the Argentine Republic in South America, and in England, India, Australia, China and Japan. It is expected that the officers will be the same as heretofore, namely: George Westinghouse, Jr., president; Joseph W. Marsh, vice-president and general manager; F. A. Rinehart, secretary and treasurer; P. H. W. Smith, assistant manager; C. M. Hagen, auditor; W. A. Conner, general superintendent manufacturing department, and Henry W. Fisher, electrician and chemist. The company's branch offices are ably manned by George L. Wiley, manager of eastern sales department, Times building, New York; E. W. Dugdale, 336 North Broad street, Philadelphia, Pa., and J. R. Wiley, manager western sales department, the Rookery, Chicago, Ill.

## BUSINESS.

The General Electric company has secured an order from the Cataract Construction company for one 500 kilowatt rotary converter for use in supplying current to the Buffalo & Niagara Falls Railway company.

The Electric Appliance company, Chicago, has issued and distributed an attractive calendar for 1896. Combined with the calendar is a carefully prepared moonlight schedule for the entire year of 1896, making the calendar doubly useful.

The Whittendon Manufacturing company, Taunton, Mass., is increasing the power plant in its Westville (Mass.) spinning mills by the addition of a 300 horse power Ball tandem compound condensing engine, built by the Ball Engine company, Erie, Pa.

Among the recent contracts closed for auto-telephones is a complete inter-communicating plant for the large Wolff apartment building in Chicago. This system is finding many users in buildings of this kind, owing to its simplicity and convenience. Richards & Meacham, 84 and 86 La Salle street, are the sole agents for Chicago and vicinity.

Among recent orders taken by the James Leffel & Co. of Springfield, O., builder of water wheels, is one for four pairs of 45 inch Samson wheels on horizontal shafts, aggregating 5,600 horse power, for the Glen Manufacturing company pulp mills, Berlin Falls, New Hampshire. These are to take the place of four pairs of wheels now in use, built by a Massachusetts company. Three pairs have already been shipped; the fourth pair is in course of construction.

No better indication could be had of the rapid growth of the electrical business in the Northwest than the prosperous appearance of the establishment of the Electrical Engineering company of Minneapolis. Years ago this company was started by its present president and general manager, Morgan Brooks, and since the start has grown at a remarkable rate until there are few, if any, that would question its claim of being the largest supply house in the Northwest. A funny but nevertheless very pertinent and significant illustration of the manner in which the residents of Minneapolis look upon

the Electrical Engineering company was brought to the attention of a representative of the WESTERN ELECTRICIAN during a recent visit to that city. General Manager Brooks made the statement, and verified it by an exhibition of the proofs, that even the postoffice officials have paid them the high compliment of delivering to them letters addressed to "Largest Electrical Supply House, Minneapolis, Minn." This of course speaks for itself as an evidence of the prosperity of the company. The Electrical Engineering company is agent for the Siemens & Halske company's machinery and has recently installed a very interesting plant in the North Star Woolen Mills in Minneapolis. The outfit consists of one of the Siemens & Halske 500 light slow-speed exterior commutator machines and is run by water power. The wiring of this installation is remarkable for its thoroughness. It may be said that the Electrical Engineering company's motto is "the best work at fair prices."

"The Superiority of Electric Storage Traction" is dealt with by Stern & Silverman of Philadelphia in a handsome cloth-bound book just published. This firm argues that storage battery roads, properly operated, are superior to any of the present methods of propulsion for street railways for decreased cost of installation, greater reliability and less cost of maintenance. The approved method contemplates the use of a battery "large enough to propel the car for three or four hours, although it is intended to make one trip only—allowing, of course, a very large margin of safety. The car, in running through the barn, at the end of each trip, stops over a pit, and in 30 seconds, less time than is required for changing horses, the discharged battery is removed and a new one attached and connections made." This plan naturally makes the battery much less in weight and space than anything heretofore used, and allows it to be carried on the truck instead of in the car. In relation to economy, Stern & Silverman make this statement: "Where batteries are purchased, substantial guarantees are furnished by the Electric Storage Battery company, covering the operation, efficiency and maintenance of same Where we assume the contract for the entire installation under our plans, they are prepared to furnish guarantees covering total operating expenses."

The Emerson Electric Manufacturing company of St. Louis shows a low priced distribution cut-out which it has been handling through the trade for some time, and which is very popular in place of branch blocks. Its price brings it within the reach of any installation, and there is no question of the convenience of distribution cut-outs. Any specialties in this line as well as alternating current motors are supplied by the Emerson company, which can furnish either the finest or the cheapest lines of distribution boards of all kinds from dynamo switchboards to the distribution cut-out referred to above.

The Kester Electric Manufacturing company of Buffalo has just completed an automatic machine for making dynamo brushes, which is stated to be the only one in the United States. With this machine the company makes its patent, ventilated, self-lubricating dynamo and motor brushes of wire cloth up to three inches in width. Almost any sized brush can be made at the rate of one complete brush per minute. This machine cost over $1,800 and is a great success. The company has just received a large consignment of wire cloth from Scotland, and will place the wire cloth brushes on the market at a price that will suit everybody. It now makes a set of dynamo brushes while you wait.

Schiff, Jordan & Co. of Vienna, Austria, have recently appointed Frank S. DeRonde, 2 Liberty street, New York, sole agent for the United States and Canada for their high grade carbon for electrie lighting. No better choice could be made in the selection of a gentleman who has a thorough knowledge of the electrical trade in all parts of this country and the proper way to most quickly present a first-class article to its attention. Mr. DeRonde reports that in the few weeks he has been in charge of this business he has been favored with a large number of orders. The various sizes of the well-known Ship cored carbons will be carried in stock ready to fill all orders promptly. The carbon is said to be free from dust and impurities, burning noiselessly and steadily.

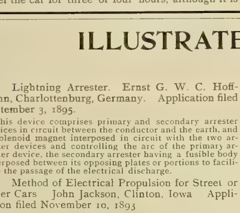
# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued January 28, 1896.*

553,528. Lightning Arrester. Ernst G. W. C. Hoffmann, Charlottenburg, Germany. Application filed September 3, 1895.

This device comprises primary and secondary arrester devices in circuit between the conductor and the earth, and a solenoid magnet interposed in circuit with the two arrester devices and controlling the arc of the primary arrester device, the secondary arrester having a fusible body interposed between its opposing plates or portions to facilitate the passage of the electrical discharge.

553,529. Method of Electrical Propulsion for Street or Other Cars John Jackson, Clinton, Iowa Application filed November 10, 1893



NO 553,538.

A main line conductor is employed, and a plurality of contact devices is disposed at intervals along the conductor, the conductor being provided with denuded sections opposite each contact device, and housings of insulating material which completely cover the denuded portions of the conductor, and which embrace movable parts or sections adapted to be moved out of the path of the movable parts of the contact devices to permit the approach of the same to the denuded portions of the conductor.

553,535 Telegraph Repeater Benjamin F. Merritt, Newark, N J Application filed May 20, 1895.

There are a pair of polarized relays and an automatic locking relay having a pair of vibratory levers adapted to move one in the path of the other, a pair of batteries and connections, means carried by the levers to short-circuit the batteries, and contacts for the levers of the polarized relays in the connections

553,538 Rheostat William H. Morgan, Alliance, Ohio Application filed November 21, 1891

In a rheostat the combination with a base, a resistance medium carried thereby, and a series of metal plates partly imbedded in the resistance medium, a movable contact carried by the base and adapted to engage the plates.

553,541 Automatic Railway Gate. George A Reynolds, Utica N Y Application filed February 5, 1894

The features claimed are a weight for operating the gate, a catch retaining the weight, a falling weight for tripping the catch an electric magnet catch securing the tripping weight and a circuit-maker at the railway track in circuit with the electro magnet catch

553,552 Electric Railway Conduit Alexander Beck, Atlanta Ga Application filed November 2, 1894.

As shown in the cut, a series of metallic frames is provided [illegible] opening in their tops, bars are secured to the frames, one plate is rigidly secured to the top of the frame [illegible] side of the slot, and the other plates are [illegible] applied to the top of the frame upon the opposite side of the slot. The plates are provided with vertical flanges upon their edges for the purpose of holding them in position on the frames, and serving as a guide for the [illegible] from the sides of the conduit [illegible] support for the frame and a trolley wire support [illegible] upon the frame above the sewer and [illegible] the slot

553,557 Armature for Electric Machines. Richard M Gardner, Chicago, Ill Application filed May 27, 1895.

[illegible] which project from beneath the coil and both their [illegible] outer end [illegible] from the [illegible] commutator segment, each of which [illegible] portion which extends [illegible] tightly clamped upon the outer end of one coil and [illegible] portion [illegible] tightly clamped upon the outer end of the [illegible] coil

553,596. Secondary Battery. Paul F. Ribbe, Berlin, Germany. Application filed July 10, 1895.

A double electrode for storage batteries, composed of two plates of non-conducting material held together by an acid resisting substance between them. The plates have curved recesses for receiving the active mass.

553,605. Composite Telegraphic and Telephonic Transmission. Edward E. Backus, New York, N. Y. Application filed June 17, 1895.

The combination is claimed with a telegraphic circuit main line constituting one conductor of a double wire telephone circuit, and its telegraphic relay included therein, of an induction coil having one of its windings also included in the main circuit, an auxiliary winding for the relay, and a compensation circuit containing the auxiliary relay winding and the other winding of the induction coil.

553,633. Antiseptic Diaphragm for Telephones. Emil Weschcke, San Francisco, Cal. Application filed May 9, 1895.

The device is composed of a fabric capable of absorbing an antiseptic cut into disks of suitable size to fit over the mouth-piece of a speech or sound transmitting instrument, and an annular cap adapted to press the edges of the diaphragm against the mouth-piece while using.

553,635. Underground Trolley System. Nathan H. Anspach, Chicago, Ill. Application filed August 20, 1895.

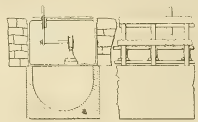
A slotted conduit is used, and a housing in the conduit is formed with a diaphragm base resilient sides are supported on the diaphragm, and a metal presser bar is supported between the sides and forms the cover for the housing; a metal service bar is formed in electrically connected sections provided with longitudinal webs extending upward into proximity with the presser-bar, and springs in the spaces between the sections of the service bar, and upon which the presser-bar rests.

553,637. Electric Arc Lamp. Ernest J. Bagnall and George Arnold, Cleveland, Ohio. Application filed October 2, 1895.

In combination with the separating magnet and carbons of an arc lamp there are employed arc-starting devices constructed and arranged to form a small arc between the carbons before the formation of the normal arc.

553,642. Register. Thomas B. Dixon, Henderson, Ky. Application filed August 20, 1894.

Electrically controlled signal operating mechanism is employed in a register, comprising two vessels and a divisible substance therein in connection with step-by-step mechanism for transferring the divisible substance from one vessel to the other, and contact points actuated by variations in the quantity of divisible substance within the respective vessels.



NO 553,552.

553,673 Incandescent Lamp Henry Green, Hartford Conn Application filed April 16, 1895

In this lamp the filament is bent to form an enlarged loop under tension, and bent out of its normal first loop position into abnormal transverse position to form a second enlarged loop under relatively high spring tension thus giving it a constant tendency to spring back toward its normal first loop position An anchor having one end connected to the filament adjacent to its free upper portion and its other end connected to the bulb holds the filament in its abnormal bent position under high spring tension, and prevents it from springing back toward its normal first loop position and thus vibration is substantially eliminated

553,675 Electro magnet Charles D Haskins, Brooklyn, N Y Application filed May 18, 1889

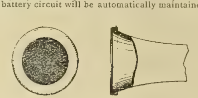
The first claim is for an electro magnet with two insulated conductors in concentric sections or helices, each conductor including an inner and outer section or helix

553,697. Electric Arc Lamp. Hans O. Swoboda, New York, and Erwin Lavens, Brooklyn, N. Y. Application filed September 6, 1894.

These features of construction are claimed for the invention: A movable frame, a brake and brake wheel carried by the movable frame, a rock-shaft provided with an arm also carried by the frame, a stop for co-acting with the arm, and an adjustable weight or weights secured to the movable frame.

553,719. Electric Battery. Johan W. T. Olan, New York, N. Y. Application filed August 5, 1892.

Claim one follows: The combination with an electric battery of a source of supply of consumable material therefor, an electro-magnet governing said supply, an instrument responding to variations of tension located in multiple arc to the battery circuit, and a circuit-breaker for the electromagnet actuated by said instrument, said circuit-breaker having adjustable liquid terminals, whereby the tension of the battery circuit will be automatically maintained.



NO. 553,633.

553,732. Electrolytic Bath and Appliance. James H. George, New York, N. Y. Application filed May 8, 1895.

The invention comprises a sectional bath for holding a solution composed of a homogeneous, flexible and insulating material provided with a concaved web, and sufficiently rigid to hold the containing solution.

553,733. Automatic Repeating Railroad Signal Robert H. Innes, San Antonio, Tex. Application filed March 30, 1895.

This device is composed of a rotary device for shifting the signal, a disk loosely mounted on the shaft of the shifting device, and having means to lock the shifting device and disk in operative engagement, and a key adapted to be actuated from the disk to send messages to the central station.

553,736 Electric Railway System John F Page, Chewacla, Ala. Application filed June 28, 1895.

One claim is for the combination of a track, a feed wire having a series of normally open branches terminating in contact plates suitably located along the track, a return conductor having two sets of normally open branches connected respectively to the respective track rails, and means for closing the circuit through the respective branches of the feed and return conductors.

553,799 Electric Railway. Moses L. Wood, U. S. Navy. Application filed September 12, 1895.

Two sets of working conductors are employed, each in the form of a closed loop divided into a plurality of blocks, each block being insulated from the blocks adjacent thereto, with switches making connection between the ends of adjacent blocks, and thus closing the loop, and electric connection between each loop of the working conductors and one of the terminals of a source of electricity

553,810 Control System for Electric Motors Gaston Sautter, Paris, and Joseph M L Savatier and Charles E de Lagabbe, La Seyne, France Application filed September 21, 1893

The first claim follows In a control system for electro motors the combination with the motor of two two-arm circuit closers, each controlling the main circuit, and adapted each to send current through the armature in a certain direction a series of speed controlling circuit closers, each controlling resistances in the main circuit an electromagnet for each of said circuit closers, an exciting circuit including the several magnets in parallel or derived branches, and circuit changing or switch mechanism for closing at will the circuit through any of the magnets.

Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, FEBRUARY 15, 1896 No. 7

## Photographic Experiments in Chicago with Röntgen Rays.

By Frank L. Perry.

Since Professor Wilhelm Konrad Röntgen gave to the world the results of his experiments with the Crookes tube and a photgraphic plate, the newspapers have been hard at work making his name famous. Experimenters in all parts of the world, with that quickness so characteristic of this age, have been industriously engaged with the so-called "X-rays," to "see for themselves" and ascertain to what extent might be believed the wonderful stories flashed from foreign shores of the German professor's work.

It may readily be believed, from the current reports that there is a "corner" in Crookes tubes, that almost every physicist with the means of experiment at hand is doing more or less in the way of an investigation of the wonderful properties of the X-rays. A number of reports have already been chronicled from eastern colleges, but it is a fact to be noted that up to the present time little beyond generalties has been published as to the practical means employed by experimenters to secure results. The public has been regaled with remarkable and startling accounts of what is being done with the X-rays; their brilliant future is already so heavily discounted that even at this early date the time is ripe in which to begin the sifting process to ascertain and publish reports of experiments more in detail.

On Saturday afternoon, February 8th, it was the privilege of the writer to be present at what may prove to be one of the first, if not the first, of the succesful experiments in Chicago to produce a "shadowgraph" of the bones of a man's hand with the aid of a Crookes tube and a photographic plate.

On the afternoon in question an interested party of electricial men gathered in one of the rooms in the experimental department of the Western Electric company's factory on Clinton street. An invitation to witness the experiments had been extended to the party by Inventor C. E. Scribner of the Western Electric company and Dr. James Burry. The experiments had been undertaken by Mr. Scribner at the instance of Dr. Burry, who had procured a suitable Crookes tube after much difficulty; and a number of partially successful tests had been made previously, but none of these had equaled in importance those of Saturday afternoon.

With a view of giving its readers a detailed description and a correct idea of the manner in which these exceedingly interesting but nevertheless very simple experiments were carried on, the Western Electrician photographed two of the experiments while in progress, reproducing herewith these and other photographs and shadowgraphs taken at the time.

In the first experiment it was decided to attempt to make a shadowgraph of the bones of Mr. Scribner's hand by the aid of the X-rays, and also to secure at the same time for comparison's sake, at the side of the impression of the hand, a shadowgraph of a small block of wood in which a bicycle bearing ball had been embedded. A bullet, too, about three-eighths of an inch in diameter, was placed under the flesh of the hand between thumb and forefinger.

In this first experiment an eight by 10 inch Seed "26 X" photograpic plate was employed. This plate while in the dark room had been wrapped with yellow postoffice paper before insertion in the plate-holder. In a word, the face of the plate was so protected with the yellow envelope paper and arranged in this and the experiments following that when the slide of the plate-holder was removed the film on the plate would still be protected from the daylight. The plate thus prepared, with the slide of the plate-holder in place, was brought from the dark room to the stand upon which the experiment was to be tried.

FIG. 1. PHOTOGRAPHIC EXPERIMENTS IN CHICAGO WITH RÖNTGEN RAYS.—SHADOWGRAPH OF F. R. M'BERTY'S HAND, FULL SIZE, WITHOUT RETOUCHING.

In order more clearly to understand this experiment, it will be well to refer to Figs. 2 and 3. In these views may plainly be seen Mr. Scribner's hand resting on the plate holder, the Crookes tube suspended about 9½ inches above the hand and plate-holder, the induction coil, the motor-driven circuit interrupter and the condenser boxes. In this first experiment Mr. Scribner's hand had been placed on the slide of the closed plate-holder and then covered with two thicknesses of daylight-proof black cloth. After having been thus protected by the cloth, the slide of the plate-holder was withdrawn so as to allow the flesh of the hand to come directly into contact with the envelope paper, only the latter keeping the hand from contact with the film of the plate. In this manner Dr. Burry and Mr. Scribner sought to secure more marked results by bringing the subject of the proposed shadowgraph closer to the plate,

and yet keeping the plate from the diffused daylight of the room.

Fig. 2 shows Mr. Scribner's hand as it appeared in position on the plate-holder before the slide had been withdrawn, and Fig. 3 shows his hand when covered with the two thicknesses of black cloth during the exposure to the X-rays from the tube above.

This exposure of Mr. Scribner's hand lasted 35 minutes, and a very fair result is plainly shown in Fig. 4.

A second experiment tried on this occasion was to ascertain if it was not possible to produce with the apparatus at hand a shadowgraph of a broken wrist bone. Adjudged from the appearance of the plates of the previous experiments taken in the manner just described, and the negative of Mr. Scribner's hand, Fig. 4, it seemed that a 35 minutes' exposure had hardly been time enough to produce a shadowgraph of bones in as thick an object as a wrist. This, it would seem, is clearly indicated in Fig. 4 by the distinctness with which the bones of the finger tips are shown as compared with the failure to obtain in the same picture a representation of the bones in the thicker part of the hand nearer the wrist.

Andrew Settervall, an employé of the Illinois Steel company, had been secured by Dr. Burry as a subject, and Fig. 5 shows Mr. Settervall with his wrist in position for the experiment, by which it was hoped to reveal evidences of two breaks between wrist and elbow, the fractures having occurred two months before. This exposure was made in a manner similar to the first, but lasted 40 minutes. The negative obtained seemed to indicate, however, that the exposure had not been long enough, for although the shadow of wrist was clearly impressed on the film of the plates, no bones were shown.

Later on in the afternoon a third test was made with the hand of F. R. McBerty, Mr. Scribner's laboratory assistant. Mr. McBerty attained the distinction of having helped to obtain the best shadowgraph thus far of the human hand secured during these particular experiments. A reproduction of Mr. McBerty's hand is shown full size and with no retouching of negative or print as a front page illustration of this issue.

The time of exposure to obtain the shadowgraph of Mr. McBerty's hand was 50 minutes. It is interesting to note that in this experiment an attempt was made to "stop down" the X-rays, as indicated in Fig. 6, with a leaden diaphragm about one-sixteenth inch (scant) thick and 10½ inches in diameter, with a half-inch aperture. The distance in this case from plate to diaphragm was about 10 inches, while the distance from plate to tube above was about 11 inches. The curious feature in the shadowgraph of McBerty's hand was the fact that the line of the joint at the finger tips is so clearly indicated. The appearance of this picture, where the eye runs from finger to wrist, would seem to indicate that better results will be obtained where the time of exposure is increased or, perhaps, a stronger source of X-rays employed.

For the benefit of those who may wish to profit by the study of these experiments, the following details are given:

Current for a circuit interrupter was first taken from a 50 volt storage battery circuit. A current interrupter was attached to the end of the armature shaft of a one-eighth horse power motor which ran at about 800 revolutions, giving 1,600 interruptions per minute. This interrupter was connected as indicated in the diagram, Fig. 7, with three cells of storage battery, working approximately at a voltage of six volts, and the circuit was completed through the primary coil of a Western Electric three-inch gas lighting spark coil. The secondary from this three-inch spark coil was connected to the Crookes tube, as indicated in the pictures of the experiments, but shown more clearly in Fig. 6. The whole arrangement was exceedingly simple to anyone familiar with ordinary electrical apparatus. A two and one-half microfarad condenser bridged, as indicated, the circuit from interrupter to primary coil. For developing the photographic plates eikonogen-hydrochinon was used.

For the sake of accuracy it should be stated that during the attempt to make a photograph of Mr. Settervall's wrist the motor was speeded up to about 4,000 alternations per minute.

Relative to the Crookes tube it should be explained that it was hung as indicated in Fig. 6, one teat on the left resting in a wire loop from the wooden support above, while the upper portion of the bulb rested on the opposite wooden support to the right. The cathode directly at the top of the tube terminated in an aluminum disk about five-eighth inch in diameter, and the tube was so hung that the cathode rays of fluorescence would beat down, as it were, upon the lower portion of the tube and through to the plate. In the experiments the anode was made at the terminal at the lower right hand side of the tube.

Among those who witnessed the experiments, outside of Inventor C. E. Scribner, F. R. McBerty, his assistant, and Dr. James Burry, were: E. M. Scribner, J. C. Warner, E. P. Warner, H. H. Wait, C. L. Jenness, M. O. Slocum, E. Parmalee Prentice, J. L. McQuarrie, W. I. Jenkins, William H. Gardiner, Gayton A. Douglass, W. Forman Collins and Frank L. Perry.

Credit should be given to W. I. Jenkins for the excellent photographs of the experiments and to William H. Gardiner, the Western Electric company's photographer, for his careful work in the development of the shadowgraphs.

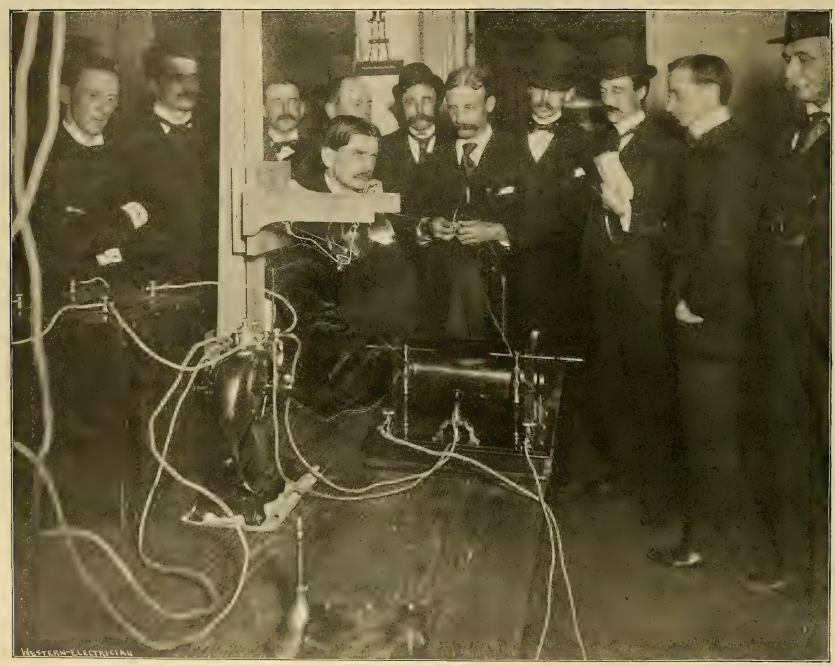


FIG. 3. PHOTOGRAPHIC EXPERIMENTS IN CHICAGO WITH RÖNTGEN RAYS.—ARRANGEMENT DURING EXPOSURE FOR FIG. 4.

## Following Röntgen's Experiments.

Interest in the new developments following the announcement of Prof. Röntgen's discovery is not confined to any locality or class. Universities and colleges throughout the country are looking into the subject, inventors and experimenters are satisfying their own curiosity by repeating the experiments already described and applying new tests. In Chicago, Prof. Michelson of the University of Chicago is following a series of experiments for the purpose of determining the exact nature of the X-rays. He is not entirely satisfied with Prof. Röntgen's theory. A dispatch from Baltimore says that Prof. Rowland has been conducting similar experiments, and he, too, is not prepared to accept the opinion of the European physicist. In numerous colleges and in all the great laboratories of the country the subject is receiving careful study and as the gentlemen conducting these experiments are exchanging views and comparing results daily, there is hope that much more information will be at hand at an early date.

## A New Form of Radiation.[1]

By Prof. Wilhelm Konrad Röntgen.

1. If we pass the discharge from a large Rühmkorff coil through a Hittorf or a sufficiently exhausted Lenard, Crookes, or similar apparatus, and cover the tube with a somewhat closely-fitting mantle of thin black cardboard, we observe in a completely darkened room that a paper screen washed with barium-platino-cyanide lights up brilliantly and fluoresces equally well whether the treated side or the other be turned towards the discharge tube. Fluorescence is still observable two meters away from the apparatus. It is easy to convince oneself that the cause of the fluorescence is the discharge apparatus and nothing else.

2. The most striking feature of this phenomenon is that an influence (*Agens*) capable of exciting brilliant fluorescence is able to pass through the black cardboard cover, which transmits none of the ultra-violet rays of the sun or of the electric arc, and one immediately inquires whether other bodies possess this property. It is soon discovered that all bodies are transparent to this influence, but in very different degrees. A few examples will suffice. Paper is very transparent;[2] the fluorescent screen held behind a bound volume of 1,000 pages still lighted up brightly; the printer's ink offered no perceptible obstacle. Fluorescence was also noted behind two packs of cards; a few cards held between apparatus and screen made no perceptible difference. A single sheet of tinfoil is scarcely noticeable; only after several layers have been laid on top of each other is a shadow clearly visible on the screen. Thick blocks of wood are also transparent; fir planks 2 cm. to 3 cm. thick are but very slightly opaque. A film of aluminum about 15 mm. thick weakens the effect very considerably, though it does not entirely destroy the fluorescence. Several centimeters of vulcanized India rubber let the rays through.[3] Glass plates of the same thickness behave in a different way, according as they contain lead (flint glass) or not; the former are much less transparent than the latter. If the hand is held between the discharge tube and the screen, the dark shadow of the bones is visible within the slightly dark shadow of the hand. Water, bisulphide of carbon, and various other liquids behave in this respect as if they were very transparent. I was not able to determine whether water was more transparent than air. Behind plates of copper, silver, lead, gold, platinum, fluorescence is still clearly visible, but only when the plates are not too thick. Platinum 0.2 mm. thick is transparent; silver and copper sheets may be decidedly thicker. Lead 1.5 mm. thick is as good as opaque, and was on this account often made use of. A wooden rod of 20 by 20 mm. cross-section, painted white, with lead paint on one side, behaves in a peculiar manner. When it is interposed between apparatus and screen it has almost no effect when the X-rays go through the rod parallel to the painted side, but it throws a dark shadow if the rays have to traverse the paint. Very similar to the metals themselves are their salts, whether solid or in solution.

3. These experimental results and others lead to the conclusion that the transparency of different substances of the same thickness is mainly conditioned by their density; no other property is in the least comparable with this.

The following experiments, however, show that density is not altogether alone in its influence. I experimented on the transparency of nearly the same thickness of glass, aluminum, calcspar and quartz. The density of these substances is nearly the same, and yet it was quite evident that the spar was decidedly less transparent than the other bodies, which were very much like each other in their behavior. I have not observed calcspar fluoresce in a manner comparable with glass.

4. With increasing thickness all bodies become less transparent. In order to find a law connecting transparency with thickness, I made some photographic observations, the photographic plate being partly covered with an increasing number of sheets of tinfoil. Photometric measurements will be undertaken when I am in possession of a suitable photometer.

5. Sheets of plantinum, lead, zinc, and aluminum were rolled until they appeared to be of almost equal transparency. The following table gives the thicknesses in millimeters, the thicknesses relative to the platinum sheet and the density:

| Thickness | Relative Thickness | Density. |
|---|---|---|
| Pt. 0.018 | 1 | 21.5 |
| Pb. 0.05 | 3 | 11.3 |
| Zn. 0.10 | 6 | 7.1 |
| Al. 3.5 | 200 | 2.6 |

It is to be observed in connection with these figures that although the product of the thickness into the density may be the same, it does not in any way follow that the transparency of the different metals is the same. The transparency increases at a greater rate than this product decreases.

6. The fluorescence of barium-platino-cyanide is not the only recognizable phenomenon due to X-rays. It may be observed, first of all, that other bodies fluoresce —for example, phosphorus, calcium compounds, uranium glass, ordinary glass, calcspar, rock salt, etc.

Of especial interest in many ways is the fact that photographic dry plates show themselves susceptible to X-rays. We are thus in a position to corroborate many phenomena in which mistakes are easy, and I have, whenever possible, controlled each important ocular observation on fluorescence by means of photography. Owing to the property possessed by the rays of passing almost without any absorption through thin sheets of wood, paper or tinfoil, we can take the impressions on the photographic plate inside the camera or paper cover whilst in a well-lit room. In former days this property of the ray only showed itself in the necessity under which we lay of not keeping undeveloped plates, wrapped in the usual paper and board, for any length of time, in the vicinity of discharge tubes. It is still open to question whether the chemical effect on the silver salts of photographic plates is exercised directly by the X-rays. It is possible that this effect is due to the fluorescent light which, as mentioned above, may be generated on the glass plate or perhaps on the layer of gelatin. "Films" may be used just as well as glass plates.

I have not as yet experimentally proved that the X-rays are able to cause thermal effects, but we may very

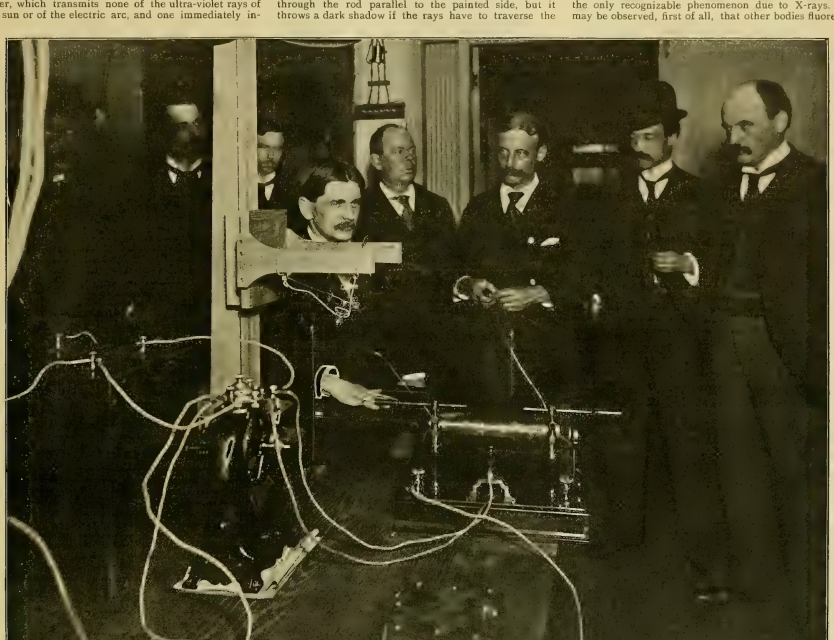



FIG. 2. PHOTOGRAPHIC EXPERIMENTS IN CHICAGO WITH RÖNTGEN RAYS.—C. E. SCRIBNER'S HAND IN POSITION TO PRODUCE SHADOWGRAPH REPRODUCED IN FIG. 4.

1. Preliminary communication to the Würzburg Physico-medical society.

2. By the "transparency" of a body I denote the ratio of the brightness of a fluorescent screen held right behind the body in question to the brightness of the same screen under exactly the same conditions, but without the interposing body.

3. For brevity's sake I should like to use the expression "rays," and to distinguish these from other rays I will call them "X-rays."

well take their existence as probable, since it is proved that the fluorescent phenomenon alters the properties of X-rays, and it is certain that all the incident X-rays do not leave the bodies as such.

The retina of the eye is not susceptible to these rays. An eye brought close up to the discharge apparatus perceives nothing, although, according to experiments made, the media contained in the eye are fairly transparent.

7. As soon as I had determined the transparency of different substances of various thicknesses I hastened to ascertain how the X-rays behaved when passed through a prism—whether they were refracted or no. Water and carbon disulphide in prisms of about 30° refractive angle showed neither with the fluorescing screen nor with the photographic plate any sign of refraction. For purposes of comparison the refraction of light rays was observed under the same conditions; the refracted images on the plate were respectively about 10 mm. and 20 mm. from the non-refracted one. With an aluminum and a vulcanized-rubber prism of 30° angle I have obtained images on photographic plates in which one may perhaps see refraction. But the matter is very uncertain, and even if refraction exist it is so small that the refractive index of the X-ray for the above materials can only be, at the highest, 1.05. Using the fluorescent screen, I was unable to discover any refraction at all in the case of the aluminum and the rubber prism.

Researches with prisms of denser metals have yielded up to now no certain results, on account of the small transparency and consequently lessened intensity of the transmitted ray.

In view of this state of things, and the importance of the question whether X-rays are refracted on passing from one medium to another, it is very satisfactory that this question can be attacked in another way than by means of prisms. Finely powdered substances in sufficient thicknesses only allow a very little of the incident light to pass through, and that is dispersed by refraction and reflection. Now, powdered substances are quite as transparent to X-rays as are solid bodies of equal mass. Hence it is proved that refraction and regular reflection do not exist to a noticeable degree. The experiments were carried out with finely-powdered rock salt, with pulverulent electrolytic silver, and with the zinc powder much used in chemical work. In no case was any difference observed between the transparency of the powdered and solid substance, either when using the fluorescent screen or the photographic plate.

It follows from what has been said that the X rays cannot be concentrated by lenses; a large vulcanized-rubber and glass lens were without influence. The shadow of a round rod is darker in the middle than at the

FIG. 4. PHOTOGRAPHIC EXPERIMENTS IN CHICAGO WITH RÖNTGEN RAYS.—RESULT OF FIRST EXPERIMENT.

edge; that of a tube filled with any substance more transparent than the material of the tube is lighter in the middle than at the edge.

The question of the reflection of the X rays is settled in one manner by the preceding paragraphs, and no appreciable regular reflection of the rays from the substances experimented with need be looked for. Other investigations, which I will describe here, lead to the same result. Nevertheless, an observation must be mentioned which at first sight appears to contradict the

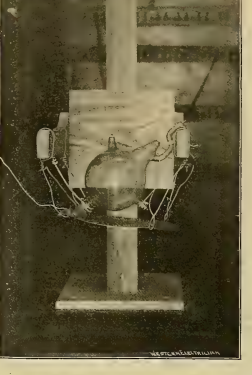


FIG. 6. PHOTOGRAPHIC EXPERIMENTS IN CHICAGO WITH RÖNTGEN RAYS.—CROOKES TUBE IN POSITION OVER PLATE-HOLDER, LEAD DIAPHRAGM INTERPOSED.

above statement. I exposed a photographic plate to the X-rays, protected against light rays by black paper, the glass side being directed toward the discharge tube. The sensitive layer was nearly covered, star-fashion, with blanks of platinum, lead, zinc and aluminum. On developing the negative it was clearly noticeable that the blackening under the platinum, lead, and especially under the zinc, was greater than in other places. The aluminum had exercised hardly any effect. It appeared, therefore, that the three above-mentioned metals had reflected the rays. Nevertheless other causes for the greater blackening were thinkable, and in order to make sure I made a second experiment, and laid a piece of thin aluminum, which is opaque to ultra-violet rays though very transparent to X-rays, between the sensitive layers and the metal blanks. As again much the same result was found, a reflection of X-rays by the above mentioned metals was demonstrated. But if we connect these facts with the observation that powders are quite as transparent as solid bodies, and that, moreover, bodies with rough surfaces are, in regard to the transmission of X-rays, as well as in the experiment just described, the same as polished bodies, one comes to the conclusion that regular reflection, as already stated, does not exist, but that the bodies behaved to the X-rays as muddy media do to light.

Again, as I could discover no refraction at the point of passage from one medium to another, it would seem as if the X-rays went through all substances at the same speed, and that in a medium which is everywhere, and in which the material particles are embedded; the particles obstructing the propagation of the X-rays in proportion to the density of the bodies.

9. Hence it may be that the arrangement of the particles in the bodies influence the transparency; that, for example, equal thicknesses of calcspar would exhibit different transparencies according as the rays were in the direction of the axis or at right angles to it. Researches with calcspar and quartz have yielded a negative result.

10. It is well known that Lenard, in his beautiful investigation on Hittorf cathode rays passed through thin aluminum foil, came to the conclusion that these rays were actions in the ether, and that they pass diffusively through all bodies. I have been able to say the same about my rays.

In his last work Lenard has determined the absorption co-efficient of various bodies for cathode rays; and among other things for air atmospheric pressure at 4.1, 3.4, 3.1, 2.8 per centimeter, and found it connected with the exhaustion of the gas contained in the discharge apparatus. In order to estimate the discharge pressure by the spark-gap method, I used in my researches almost always the same exhaustion. I succeeded with a Weber photometer (I do not possess a better one) in comparing the intensity of the light of my fluorescing screen at distances of about 100 mm. and 200 mm. from the discharge apparatus, and found in the case of three tests agreeing well with one another that it varied very nearly inversely as the square of the distance of the screen from the discharge apparatus. Hence the air absorbs a very much smaller fraction of the X-rays than of the cathode rays. This result is also quite in agreement with the result previously mentioned, that the fluorescing light was still observable at a distance of two meters from the discharge apparatus.

Other bodies behave generally like air—that is to say, they are more transparent for X-rays than for cathode rays.

11. A further noteworthy difference in the behavior of cathode rays and X-rays consists in the fact that, in spite of many attempts, I have not succeeded, even with very strong magnetic fields, in deflecting X-rays by a magnet. The magnetic deflection has been up to now a characteristic mark of the cathode ray; it was, indeed, noticed by Hertz and Lenard that there were different kinds of cathode rays "distinguishable from one another by their phosphorescing powers, absorption and magnetic deflection," but a considerable deflection was nevertheless observed in all cases, and I do not think this characteristic will be given up without overwhelming evidence.

12. After experiments bearing specially on this question it is certain that the spot on the wall of the discharge apparatus which fluoresces most decidedly must be regarded as the principal point of the radiation of the X-rays in all directions. The X-rays thus start from the point at which, according to the researches of different investigators, the cathode rays impinge upon the wall of the glass tube. If one deflects the cathode rays within the apparatus by a magnet, it is found that the X-rays are omitted from another spot—that is to say, from the new termination of the cathode stream.

On this account, also, the X-rays, which are not deflected, can not merely be unaltered reflected cathode rays passing through the glass wall. The greater density of the glass outside the discharge tube cannot, according to Lenard, be made responsible for the great difference in the "deflectability."

I therefore come to the conclusion that the X-rays are not identical with the cathode rays, but that they are generated by the cathode rays at the glass wall of the discharge apparatus.

13. This excitation does not only take place in glass, but also in aluminum, as I was able to ascertain with an apparatus closed by a sheet of aluminum two mm. thick. Other substances will be studied later on.

14. The justification for giving the name of "rays" to the influence emanating from the wall of the discharge apparatus depends partly on the very regular shadows which they form when one interposes more or less transparent bodies between the apparatus and the fluorescing screen or photographic plate. Many such shadow pictures, the formation of which possesses a special charm, have I observed—some photographically. For example, I possess photographs of the shadow of the profile of the door separating the room in which was the discharge apparatus from the room in which was the photographic plate; also photographs of the shadows of the bones of the hand, of the shadow of a wire wound on a wooden spool, of a weight enclosed in a small box, of a compass in which the magnetic needle is completely surrounded by metal, of a piece of metal the lack of

homogeneity of which was brought out by the X-rays, etc.

To show the rectilinear propagation of the X-rays there is a pinhole photograph, which I was able to take by means of the discharge apparatus covered with black paper. The image is weak, but unmistakably correct.

15. I looked very carefully for interference phenomena with X-rays, but unfortunately, perhaps only on account of the small intensity of the rays, without success.

16. Researches to determine whether electrostatic forces affect X-rays in any way have been begun, but are not completed.

17. If we ask what X-rays, which certainly cannot be cathode rays, really are, we are led at first sight, owing to their powerful fluorescing and chemical properties, to think of ultra-violet light. But we immediately encounter serious objections. If X-rays be in reality ultra-violet light this light must possess the following characteristics:

(*a*) It must show no perceptible refraction on passing from air into water, bisulphide of carbon, aluminum, rock-salt, glass, zinc, etc.

(*b*) It must not be regularly reflected to any appreciable extent from the above bodies.

(*c*) It must not be polarized by the usual means.

(*d*) Its absorption must not be influenced by any of the properties of substances to the same extent as it is by their density.

In other words, we must assume that these ultra-violet rays behave in quite a different manner to any infra-red, visible, or ultra-violet rays hitherto known. I could not bring myself to this conclusion, and I have, therefore, sought another explanation.

There seems at least some connection between the new rays and light rays in the shadow pictures, and in the fluorescing and chemical activity of both kinds of rays. Now, it has been long known that besides the transverse light vibrations, longitudinal vibrations might take place in the ether, and according to the view of different physicists must take place. Certainly their existence has not up till now been made evident, and their properties have not on that account been experimentally investigated.

May not the new rays be due to longitudinal vibrations in the ether?

I must admit that I have put more and more faith in this idea in the course of my research, and it behooves me therefore to announce my suspicion, although I know well that this explanation requires further corroboration.

## Dielectric Strength of Oils Under Alternating Potentials.

By Elihu Thomson.

In the course of tests made under the direction of the writer some two or three years ago, the interesting fact was noticed that the striking distances of high potentials in insulating oils were in some way variable with the frequency of the current or potential waves, or upon the time during which electric stresses existed in a given direction through the medium.

This relation has been confirmed by other and later experiments. The general effect was found to be that discharges at low frequencies are capable of puncturing mineral oil layers up to from one-third to one-half the thickness of an air layer required to just resist puncture by the same discharges, while with high frequencies of equal striking distance in air, an oil layer of one-thirtieth to one-sixtieth of the thickness of the air layer was sufficient to prevent discharges. At frequencies such as 125 per second a potential which would give one-half inch spark in air may puncture from one-third to one-fourth inch of oil between the electrodes, while at frequencies of 50,000 to 100,000 a layer of oil of one-fourth inch may resist puncture when the spark in air is as much as eight inches. The high frequencies experimented with were such as are given by condenser discharges over an air gap including a primary of a few turns, with a secondary of a single layer of some hundreds of turns immersed in oil. The discharges, in such case, are not continuous waves, but a rapid succession of oscillatory discharges with dead intervals or periods of inactivity intervening.

The effect of carefully drying an oil was found to increase its insulating power. This was also true to a marked extent when careful filtering was resorted to, a decided decrease of striking distance through the oil with the lower frequencies being observed. It follows from this that all oil used in insulating for high potentials with low frequencies should be kept clean and homogeneous, and free from floating particles.

Variations of temperature of oil did not, in the experiments made, greatly affect the striking distances for a given potential. The general fact, however, that with high frequencies the insulating power of oil layers is, as measured by the striking distance in air relatively to that in the oil, far in excess of such insulating power, for low frequencies seem to be unaffected by the dryness, clearness or temperature of the oil used.

It appears probable, also, that with partially conducting liquids like alcohol and water the behavior with high frequencies is more like that of a true dielectric insulator than with low frequencies. As an interesting fact in this connection it may be noted that a high potential high frequency coil capable of yielding spark torrents over 30 inches inches of air gap between its terminals still maintains its discharges even when shunted by a glass tube 1½ inches in diameter containing ordinary water and long enough to bridge the gap.

It is difficult to account for the differences in the effects obtained with high frequencies from those with low frequency alternating waves. A time lag in the establishment of the full dielectric stress or full electrostatic field in the oil might account for the phenomena. According to this hypothesis, if two electrodes under oil, separated a certain distance, instantly acquire a difference of potential, this potential would not with equal rapidity strain the oil to the full extent. It might be assumed that the polarization of the oil molecules requires time. Or, it may be that only such part of the electrostatic field as is due to the ether is first established after electrification, and that the increase of such

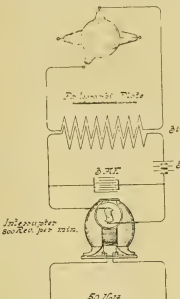



FIG. 7. PHOTOGRAPHIC EXPERIMENTS IN CHICAGO WITH RÖNTGEN RAYS.—DIAGRAM SHOWING ARRANGEMENT OF ELECTRICAL APPARATUS.

field, due to the molecules of the substance, such as the interposed oil, is subsequent to the former.

If this were so the establishment of an electrostatic field at high rates in oils would present analogies with the case of magnetic fields in iron or metals.

It would also follow, if the supposition of a lag as above be true, that in condensers such as those using oil as a dielectric the capacity would be less the higher the frequency. Again, if any such lag as is assumed exists, it would probably vary with different insulating media and it may depend upon the molecular states, as viscosity, for example. Observations of the oil space between the immersed electrodes by polarized light could probably be used with certain media to detect any differences in time of establishment of electrostatic stress with different frequencies, it being well known that under high stresses certain insulating liquids become strongly affected in their optical properties, with rotation of polarized beams of light traversing them. If the optical effect noticed should be less in the case of high frequencies than with low rates, it would indicate a probable lag of the kind assumed. Similar studies using solid dielectrics like glass, mica, etc., would also be desirable. Should the results be negative it would be necessary to attack the problem in some other way.

M. P. Jaret, about a year or more ago, in a communication to the Paris Academy of Sciences, gave the results of his investigation of the properties of mica. He found that it did possess, with rapid oscillations, what might be termed a dielectric hysteresis. Such a property may exist to a more marked degree in oils.

In the tests of the power of oil layers to withstand puncturing by high potentials a curious effect was noticed, which was that discharges under oil passed far more readily between balls than between sharp points. In other words, with any given difference of potential between the immersed electrodes, as measured by the air spark obtainable, pointed electrodes could be brought much nearer than balls without provoking puncture. With balls of one-half inch diameter as terminals, and with low frequency (125), potential differences ranging from 100,000 to 150,000 volts, the space between the points could be one-quarter that between the balls. The ratio between the length of spark in air and between sharp points in oil was 10 to 1 at 10,000 volts, and 8 to 1 at 75,000, while with balls these ratios fell to 2.4 to 1 and 2 to 1, respectively. When flat plates were substituted for the balls the striking distance in oil was still further increased as compared with the distance with points. The seemingly anomalous action of points under oil, so different from their action in gases or air, is certainly curious, and the usual injunction to avoid points and edges, as conducive to electric discharge, does not seem to apply in such media as oil, at least when the potentials are alternating and at ordinary frequencies.

In experimenting with discharges in oil uniform results are only to be obtained by using carefully filtered oil, as ordinarily they contain suspended particles, fibers, etc., which appear to bridge the space between the electrodes and provoke a breakdown due to the non-homogenous character of the dielectric. It is also necessary to discard oil after arcing has once occurred through it, as it will have become much weaker, owing doubtless to the fine carbon particles set free and which remain floating ready to be drawn into the space between the electrodes, thus giving rise to loss of homogeneity of the medium.

The Colliery Engineer company of Scranton, Pa., proprietor of the International Correspondence Schools,

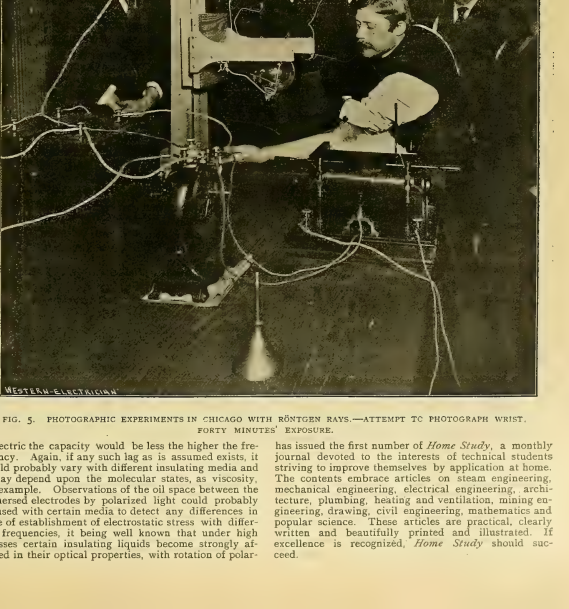



FIG. 5. PHOTOGRAPHIC EXPERIMENTS IN CHICAGO WITH RÖNTGEN RAYS.—ATTEMPT TO PHOTOGRAPH WRIST. FORTY MINUTES' EXPOSURE.

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IT may afford some relief to the mind of the zealous health commissioner of Chicago to know that another antiseptic diaphragm for telephones and speaking tubes has been invented. We have no doubt that if the attention of the inventor could be directed to the letter addressed by Commissioner Kerr to the Chicago Telephone company on the subject of "disease breeding instruments," a sample of the new device would at once be forwarded to the Health Department of Chicago.

WHATEVER criticism may have been made against former promoters of storage battery projects for giving more attention to patent litigation than the development and commercial application of the accumulator, it is certain that no such complaint can be made to-day. The storage battery is being given a fair show now; it has influential backers, and there is ample capital for the experimental and engineering work necessary for the proper application of accumulators. Mr. Lloyd, in his paper before the New York Electrical society, made an excellent showing for the battery, and recounted the successful application of the accumulator to special work in Europe as well as in this country. He has looked into the work now in progress in Europe, and his report furnishes some interesting hints for American engineers.

THE repeal of the "near crossing ordinance" which has been in force in Chicago since the first of the year, and which has just been repealed by the city council, has demonstrated the fact that the prejudice of certain newspapers will make them hold street railway companies responsible for annoyances that they cannot possibly avoid. The streets of this city have been for a long time in a filthy condition, and after the recent snow storm these thoroughfares were almost impassable. It is not to be wondered, then, that there were many complaints from persons who had occasion to patronize the street railways. In order to reach a car they were compelled to wade through slush and mud ankle deep, and when they left the car they were again compelled to wade through mud to the sidewalk or the nearest crossing. As we have already said, there was reason for complaint, but not against the street railway companies. The fault was with the street department, which was responsible for the filthy condition of the streets. Chicago streets at the present time are a disgrace to the city. We believe the people will place the blame where it belongs.

IT is always interesting to watch the progress in any line of industrial development, and, generally speaking, there is no better means of gaining information of the latest advancement than through the weekly reports issued by the Patent Office. Reference to the "Illustrated Electrical Patent Record" which appears in each issue of the WESTERN ELECTRICIAN shows that there is no abatement in the interest manifested in this field by the inventive genius of the country. This record contains in condensed form a review of the electrical patent field, and shows what is being done from week to week. It is too much to expect that every week will bring forth some great discovery that will startle the scientific world, but it may be remarked that the gradual improvement that is taking place, as shown by this record, indicates a healthy condition of the industry. The American people are progressive; they are ever on the alert for improvements, and in no other department of industrial activity has there been such constant advancement as in the electrical field. These little refinements in the art, which are being worked out every week, show that we are constantly striving for a higher standard, and that we are rapidly attaining perfection in these lines.

ELSEWHERE in this issue is presented Prof. Röntgen's communication to the Würzburg Physico-medical society on "A New Form of Radiation," which has attracted much attention abroad and has given rise to almost unlimited speculation in this country. It is admitted that Prof. Röntgen's discoveries are of vital importance, that they mark distinctive progress and that the widespread interest that has been manifested in his announcement is bound to result in still further advancement. Moreover, it is believed that the shadow pictures produced by these rays will prove of practical value in surgery. It is the opinion of the eminent scientist that his X-rays are longitudinal vibrations in the ether, and not merely ultra-violet radiation. Prof. Röntgen reports that he has not been able to show that these rays give rise to calorific effects, or are subject to any regular reflection or refraction at the surface of different media, and that they probably move with the same velocity in all bodies and in a medium which penetrates everything, and in which the molecules of bodies are embedded. The possibilities opened up by Prof. Röntgen's discovery have already attracted the minds of the most eminent scientists in this country and abroad, and while some of the predictions which were made before an authentic account of these discoveries was received in this country may not be realized, it is probable that the "new form of radiation" will lead to still further discoveries that may eventually disturb many of the theories that are now pretty generally accepted.

LAST week we called attention to the action of the state railroad commission of New York in the matter of the application of the Buffalo Traction company to establish an electric railway system in competition with the existing company. The refusal of the commission to grant the desired permission provoked much unfavorable comment, and as this is the third time the board has taken this stand, the people throughout the state are protesting against the apparent favoritism that the commission has been guilty of. The matter is again brought into prominence by two bills that were under consideration at Albany last week. One of these relates directly to the commission and bears upon this point; the other has no direct connection with the matter, but it tends to show that the rapid extension of the trolley lines throughout the state has had the effect of stirring up the steam railroad companies. A conspiracy to shut out competition is charged against the street railroad corporations of the state, which are urging the passage of the Brackett Husted bill, requiring the consent of the state railroad commission before any existing street railroad may be extended. Should this bill become a law the present companies would have an absolute monopoly of the business in every city of the state, for the state commission recently has denied three applications of companies desiring to compete with existing lines. The commissioners take the ground that this paralleling of roads is against public policy. All the street railroads in the state are said to be back of this effort to extend the powers of the commission to all additions to existing roads. While the people of Buffalo are engaged in their fight against the extension of powers of the commission, the people in the eastern part of the state are preparing for a long struggle with the steam railroad interests that hope to shut out the trolley from the Hudson river towns between Albany and New York. A bill has been introduced in the Legislature providing that the Albany post road from Albany to New York shall be a public highway forever, and prohibiting the laying of any railroad track on the road except within New York city. This would forever prevent the building of a trolley railroad in Peekskill, and there is nothing to-day that Peekskill is endeavoring more earnestly to obtain than an electric railroad. The bill places other towns along the river in the same predicament. It would prevent the paralleling of the lines of the New York Central & Hudson River Railroad company with a trolley road from New York to Albany. It is explained that the principal street in all the Hudson River villages is the Albany and New York post road, and to shut the trolley out from this road would mean to prohibit it entirely from these towns.

WHO is the biographical authority of the organ of the electrical kindergarten? Who compiled the data accompanying the portrait of Sir William Siemens, issued by that publication? The "professor" himself must have had a hand in it, for it seems incredible that anyone else could have gotten so much misinformation into such a small space. Historian Barrett tells us that Sir William Siemens "invented the Siemens armature and the self-exciting dynamo," and also that he was "first to transform mechanical into electrical power, and vice versa, without the aid of permanent magnets." And now the question arises: Who told Barrett? Can it be possible that the professor has been made the victim of a cruel practical joke? It must be so, for we know of no other person in the electrical world to-day who would be capable of such a glaring blunder. Even Hornsby ought to know better than that.

Barrett will probably say that he had nothing to do with it, and he may repeat his statement that he has "merely given the use of his name" to these Hornsby enterprises. This will not relieve him of responsibility, nor will such an admission reflect credit upon him. But this oft-repeated statement of Barrett about the "use of his name" suggests an inquiry as to whether the gentlemen whose names are so prominently paraded as his associates are actively engaged in promoting these Barrett-Hornsby enterprises, or whether they, too, have made arrangements for the use of their names. It seems hardly possible that they could entrust their personal honor and professional reputation to the keeping of Hornsby. If they have done so, they deserve the ridicule which this last blunder will certainly bring upon them, and they have also forfeited the respect of their professional brethren by practicing deception upon the public. It is time that these gentlemen made an explanation. The public is entitled to it, and the sooner they set themselves right before the community the better it will be for themselves. There are good reasons for believing that misrepresentations have been made. One cannot understand, for instance, how Dr. Carhart or Prof. Anthony could have been guilty of such a blunder as that noted in connection with the portrait of Sir William Siemens, yet if we acquit them of stupidity we can only do so by convicting them of cupidity. If they were guilty of lending their names to these schemes, they thereby sanctioned these erroneous statements which were sent broadcast with their apparent endorsement. In the case of Messrs Jackson and Thomas we can understand how they may have been so preoccupied with their numerous commercial enterprises that they might fail to give the same careful attention to such matters as might be expected from Dr. Carhart. But they cannot shirk responsibility. Their sense of professional honor should prevent them from occupying a false position before the public. An explanation is demanded, gentlemen.

## Recent Improvements in America and Europe in the Storage of Electricity.[1]

By Herbert Lloyd.

During the 10 or 15 years that cover the period during which storage batteries have been more or less in commercial use, the electricians of this country have been divided into two distinct classes, and two only those unalterably opposed to their use, and the other class firm believers, and, one might say, enthusiasts.

In Europe one gets the impression from an acquaintance with electrical engineers, in England, France and Germany, at any rate, that accumulators are considered an essential feature in almost all electrical work. Some engineers are greater advocates than others of the system, but all are apparently believers. When it is borne in mind that the discovery of secondary currents was made in 1801, and even a lead accumulator was made in 1803, it seems strange that it has only been within the last five or six years that a lead accumulator has been proven to be a commercial piece of apparatus.

A really practical storage battery was, of course, made by Planté in 1860, and another step was made in 1881, when Faure and Brush developed the battery plate made by the application of already formed active material. In about 1890 the chloride plate was developed, differing both from Brush-Faure and Planté. This plate depends for its usefulness on the peculiar and beautiful crystalline structure of the cast material. Although the present state of the art shows more than one excellent form of positive plate, there has nothing yet been produced comparable with a chloride negative plate. Its capacity for weight and ability to withstand both the use and abuse which a battery to be successful must withstand, is almost phenomenal.

In England and France the companies doing by far the greater portion of the business use no negative but a chloride negative, and in those countries there are no fundamental battery patents in existence to-day. In England one is impressed not perhaps with the magnitude of the battery installations, but by their number. Private house plants run by gas or gasoline engines are abundant. Central station batteries are being installed about as fast as central stations are built, which in England is comparatively slow. In Manchester, London, and Belfast, Ireland, very large central station batteries have been installed within the last year. The three stations just mentioned were equipped, respectively, by the Chloride syndicate in Manchester, the Epstein in London and the Electric Power Storage in Belfast, the bulk of the business being done by these three companies. During the time I spent in England the Chloride syndicate got 10 successive contracts, which were about all that were given out within that period, the fact of their having strong patents covering the only practically perfect negative plate giving them very great advantage. The combination of this negative with the best known positive produces the most effective battery obtainable.

Electric traction, of course, in England and on the continent is carried out on a very small scale, either trolley or battery traction. In Birmingham, England, a storage battery road has been in operation for some six or seven years, and has been the experimental ground for almost all makers of battery, and the service rendered was, of course, not the most satisfactory. A little over a year ago the Chloride syndicate got a contract for the equipment of all the cars of this line with their battery, and with the experience of their allied company in France at their back, they have been entirely successful, giving service satisfactory to the railroad company and doing the business at a profit to themselves.

In France the Madeleine & Saint Denis road has now been in operation over three years, running some 30 22-foot cars, double decked, seating between 50 and 60 people. These cars have run up to this time between two and three million car miles, and the company has every prospect of gradually replacing the horse cars in Paris, in the face of the most terrific competition with steam motors, compressed air motors, gas motors, and I do not know how many more. On this road some very good results have been obtained in what they call "recuperation." A very careful test covering 100 trips, about 11 miles each, give the following results, according to figures given by M. Sarcia:

"The car while descending a 10 per cent. grade could recover 57 per cent. of the energy expended in ascending it; on a four per cent. grade a return of 42 per cent. is effected, and on a two per cent. grade 23 per cent. On a one per cent. grade the recuperation is zero, with a traction coefficient equivalent to 22 pounds per ton. If the traction coefficient could be reduced to 11 pounds per ton there would be recovered, in utilizable form, according to their experience, 63 per cent. of the energy expended in ascending a 10 per cent. grade, and with that low coefficient of traction 23 per cent. could be recovered down a one per cent. grade. If the traction coefficient was zero on the level, the car having no dead resistance, either electrical or mechanical, there would be recoverable on descending a two per cent. grade 70 per cent. of useful energy, the efficiency of the battery being in this case 70 per cent. An electric mountain railroad recently built on the Isle of Man, on which the grade is almost a uniform 12 per cent., is equipped with a trolley system having a battery in the power house. On this road the car descending the grade delivers back to the battery over the line about 33 per cent. of the energy which it consumes in ascending, so that it is beyond question that these applications should be taken advantage of wherever it is possible, the economy being so apparent."

1. Read before the New York Electrical Society, January 29, 1896.

The cars that have been in operation on the Paris roads for three years are of the old type, with the batteries placed under the seats, but new cars are being equipped with one box of batteries suspended under the car, thus eliminating the many disagreeable features incident to locating the batteries under the seats. The practice heretofore has been to run 33 miles on one charge, with a battery weiging about three tons. With the newer cars the battery weighs about 1½ tons and runs one 11 mile trip on a charge, although under good conditions it would be capable of two such trips. In the new cars no mechanical brake is used at all, the braking being accomplished by the charging of the battery, although for the final stop the motor armatures are short-circuited. The motors are shunt wound, always used in multiple, and in starting resistance is inserted in the armature circuits, which is gradually removed to increase the speed until it is all out. To attain full speed, the field is weakened by inserting resistance.

The matter of charging the batteries on this road has received very careful attention, and has been modified at various times. Originally, when the road was started, the battery was charged at a constant potential, 108 cells being thrown on to a 260 volt bus. Under these conditions, the charging current commenced above 150 amperes, but gradually decreased, so that at the end of charge it had reached about 10 amperes. They now use two buses. The battery is thrown on to a bus equivalent to 2.4 volts per cell, where it is left for three hours, or until the current has fallen from 90 to about 30 amperes. At the end of the third hour the battery is thrown on to a higher bus, equivalent to 2.55 per cell, on which the charge is completed in from one to two hours more, thus avoiding the use of resistance.

The most interesting feature in connection with the operation of this road is in the method of repasting the positive plates. The positive support plate is grooved and made of an alloy, upon which there is very little electrolytic action, and by a special process the peroxide which has been deposited on the bottom of the jars in a wornout cell is repasted into these grooves. Two men are employed repasting and are able to keep some 30 cars in continuous service, so that the cost of this portion of the operation is wonderfully small. I saw a number of these grids which had run between 25,000 and 50,000 miles, showing no evidence whatever of depreciation. The casting of these girds is carried on by a special process, by which the alloy is cast under very heavy air pressure, which method is protected by an original American patent, the French patents of which have been assigned to the French Chloride company.

In a a five-wire station at Paris two very large batteries were being installed last fall, one-half being manufactured by the Chloride company, the other half by the Tudor company. This battery, which is now complete, is probably one of the largest in the world.

In Germany the Tudor company, with works at Hagen, has, during the past eight years, installed over 5,000 plants. A most interesting application of storage battery has just been made by it on the street railroad of Hanover, where the cars are propelled by storage batteries within the city limits, and run by the trolley outside, the battery being charged without removal while the cars are running through the outskirts. Forty-four cars have been installed on this plan. Battery cars are also running in Berlin, Hagen and other German cities, and also in Vienna. Up to the past year the German Tudor company has devoted its attention almost entirely to lighting work, but in Germany and France there is a feeling that the time is ripe for the development of storage battery traction, and within the next year a great deal will be accomplished in this line.

It is well known that in this country patent litigation has long interfered with the development of the storage battery business. Something over a year ago one strong company acquired all the patent rights of the contending companies, thus removing all question on the score of patents. This company, being also allied with the three strongest European companies, is able to take advantage of every improvement that is made either here or abroad, and can therefore produce the best battery obtainable.

Some months ago the New York & Harlem Railroad company of this city decided to place two storage battery cars on its Madison avenue line, to be operated through the winter, in order to determine whether or not the system has been brought to a stage of advancement which would warrant the equipment of the entire road.

In the cars run from Eighty-fifth street to One Hundred and Thirty-fifth street the batteries are suspended between the axles, on the car truck, entirely independent of the car body. In fact, so independent are the trucks that they have been run alone, without any car body on them at all.

The cars have standard Stephenson bodies 18 feet long and standard Peckham trucks. Sixty cells of nine plate traction type chloride accumulators, capacity 400 ampere hours, are placed in a tray about 4½ feet square and connected up solidly by lead burning, in two series of 30 cells each. This tray is placed on a small transfer truck, running on a narrow-gauge track in a pit eight feet below the level of the street car tracks. An electric elevator is utilized to hoist the tray full of batteries, together with transfer truck, up between the street car rails into position on the street car truck, where the tray is automatically locked and the elevator, with transfer car, withdrawn. Large contact shoes on the car, kept in place by steel springs, engage with contact plates on the trays, as batteries are raised, so that the connections are made automatically.

Each car is equipped with two G. E. 800 motors, supported outside of axles, and two "K" controllers, giving combination as follows: First, batteries parallel, motors series; second, same with shunt field; third, batteries series, motors series; fourth, same with shunt field; fifth, batteries series, motors parallel; sixth, same with shunt field. A cable system will be applied to the shifting of the transfer cars in the battery pit.

The special advantages of this particular method of battery application include the features before mentioned, of low steps for cars and the standard height and width of seats; an entire independence of car body permitting of a change, as, for instance, from open to closed car bodies and vice versa; together with an entire absence in the car of odor from the battery electrolyte; a compact, easily handled tray of batteries; utilization of space below and above the street car floor, without occupying one square foot of the car shed proper.

In the past batteries were made of a practically uniform type of small size, capacity being obtained by putting many series of cells in multiple. Now, large units in batteries have come into use just as large generating units have, an example of this being the battery installed in the Boston Edison company's station, where each cell weighs about three tons, capacity 8,000 ampere hours, or 16,000 ampere hours at 140 volts, with a maximum output of 8,000 amperes.

The size of cell could be increased almost indefinitely. Batteries are now constructed specially to suit the work for which they are intended. Until recently in isolated plants, such as private houses, 150 ampere hour cells in glass jars were generally used, as many as eight of such series being installed in one house. A private house plant has been recently installed in this city with one series of cells of 2,500 ampere hours each, and in the last three months half a dozen similar plants have been installed, varying in size from 1,000 ampere hours up.

Within the last year the question of electric train lighting has come up with considerable force, and cars are now running between New York and Chicago lighted by storage batteries alone, without any systems for operating dynamos and engines on the train. Train lighting in this country is a different matter fram train lighting in Europe. In Europe a few eight candle power lamps to the car are considered sufficient. The cars just referred to as running between New York and Chicago have 44 16 candle power lamps. A train consisting of five or six such cars requires a lighting plant of quite serious proportions.

Experiments are being made with more or less success with small dynamos driven from the axle of the car; a moderate-sized storage battery is used to maintain the lights when the speed of the train falls below some 20 miles an hour. A car so lighted is now running satisfactorily between New York and Washington.

Perhaps the application of storage batteries which will arouse greatest interest is that of stationary batteries applied to equalizing the load on trolley lines. Two or three plants of this character have been installed within the past year. In a road of considerable length the application of a storage battery would save in feeder copper a great deal more than its own first cost, and the contingent advantages to be derived from the operating of the generating plant at a practically constant load are too well known to require reiteration.

The application of batteries to electric elevator installations shows as great or even greater advantages. As Mr. Sprague stated in his paper before the last meeting of the Institute, to operate six elevators without a battery would require a 120 kilowatt generating plant, while the average load would be but 35 to 40 per cent. of this. With a properly constructed battery, he states that the direct plant could be reduced to 60 kilowatts, or even to but 50. A battery was installed last fall in connection with the elevator plant in the new court-house in Minneapolis, and the curves shown proved the effect. A similar plant is just being installed in the Chicago Board of Trade building for the same purpose.

In this class of work, it is necessary that the battery should be capable of discharging at rates which would completely exhaust it in from half an hour to an hour. These discharges, of course, are not long continued, and the batteries as now constructed are not injured by this treatment. Up to two or three years ago a 10 hour rate of discharge was considered a maximum rate. Recent improvements in the manufacture of storage batteries have been entirely along the line of producing a battery which is capable of discharging in from one to three hours, and although the cost has not materially decreased, if capacity alone is considered, when discharge rate is considered the cost has been greatly reduced, since a battery which can he discharged at five times its normal rate will replace one five times its size of the old type.

One feature of the battery business which has received a good deal of attention recently is the specific gravity of the electrolyte. The curves shown are very interesting, as they show how the capacity of a cell varies with the density of the electrolyte; the plates being respectively one-fourth inch thick and four-tenths inch thick. The thicker plate has a maximum capacity when the density of the acid is about 1,275; the one-quarter inch plate has a maximum capacity when the electrolyte is about 1,240. It is very noticeable how rapidly the capacity falls off on either side the maximum point. These curves are taken from two chloride cells, the volume of the electrolyte being sufficient to prevent any great change in specific gravity. The mean volts on discharge shown in the upper curves rise almost regularly as the acid density rises.

The rate of discharge being the same per pound of active material, the discharge rate per superficial area is therefore approximately 40 per cent. greater with the thick plate than with the thin.

The battery just being installed in the new Edison station at Twelfth street, this city, consists of 150 four thousand ampere hour cells. The positive plates of this battery somewhat resemble the Tudor type; the negatives tives are the chloride type. They are installed 75 cells

on each side of three-wire system; the 25 end cells on each side are used as regulating cells, being connected by copper bar to four regulating switches, two on each side, so that the battery can be discharged at different potentials.

The battery has a capacity at 10 hour rate of 4,000 ampere hours on each side; at a three hour rate of 3,000 ampere hours on each side, and at one hour rate of 2,000 ampere hours on each side.

The curves here shown give the percentage capacity of such a battery at rates varying from eight hour rate to one hour rate.

The erection of the battery in two tiers, the upper tier of iron framework, is perhaps new in this country. The installation of the cells is effected by a special type of oil insulator, which makes this method of erection quite safe.

The battery is installed in a room approximately 20 feet by 40 feet, which is, I think, the smallest space in which a battery of equal capacity has yet been placed.

Another Edison station recently equipped is in Lawrence, Mass., where a smaller battery, with capacity of about 1,500 ampere hours is in use; this battery is discharged completely in two hours, between four and six in the afternoon, during the peak of the load.

The carriage which secured the gold medal, first prize, in the horseless carriage contest in Chicago, was built by Caffrey of Philadelphia, and weighed complete 1,650 pounds, including a battery weghing 604 pounds. The battery consisted of 44 50 ampere-hour chloride cells; the wagon was equipped with two 1½ horse power Lundell motors with series parallel controller.

This carriage is capable of running from 25 to 30 miles on one charge at a speed of 10 miles an hour; it could attain a maximum speed of about 20 miles an hour for one hour, carrying four people. The two front wheels of the carriage are driving wheels and it is steered by the rear wheels. On the first speed, with an average discharge of 5.6 amperes, or two-thirds of an electrical horse power, a speed of 4.6 miles was attained, and at this speed the carriage would travel 46 miles on one charge. On the second speed, running at 10 miles an hour, it required 13.2 amperes, or $1\frac{5}{6}$ horse power, covering by this speed about 30 miles on one charge. This carriage has been sold and shipped to Germany to be used as a model for building similar ones over there.

This question of electric vehicles is attracting the attention of the large carriage and bicycle manufacturers, many of whom are building such vehicles, and with a battery such as is now produced, capable of very heavy discharges, and with good roads, it would appear as though the business would soon assume large proportions.

The use of electric launches is growing steadily, but not as rapidly as other applications. In this work light weight is not so important as for carriage work, but batteries for this work must have large capacity, as it is often necessary to make long runs before facilities for recharging can be obtained.

The improvement in storage cells for this work is shown in the fact that the batteries on the launches which ran for three months at the Atlanta exposition did not cost one cent for repairs, which was not the case with those used at Chicago at the World's Fair. The battery used at Atlanta was the chloride type.

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It is reported that the power house for the Union elevated loop in Chicago is to be located on the property on Market street, 300 feet south of Van Buren street, east front, the dimensions being 141 by 165 feet, extending to the river. The property was purchased recently by Marshall Field, who now leases it for 99 years to the Loop company at $6,000 per year. The building and plant will cost $300,000.

## Electric Traction on the Brooklyn Bridge.

The use of electricity in place of steam for switching the cars at either end of the Brooklyn bridge has been recognized as the only suitable method ever since the electric railway motor became a practical fact. But not until the motor had been adapted to heavy train service and had proved successful on the West Side elevated railroad at Chicago, the Nantasket Beach division of the New York, New Haven & Hartford railroad and on the Baltimore & Ohio main line, did its employment in the bridge service become possible. Trustees Howell, Henriques and Page, together with Chief Engineer Martin of the bridge corporation, have visited these roads and have become convinced of the practicability of handling the bridge trains by electric power. To enable the trustees and the engineer the better to judge of the advantages which electric power might offer over the steam power hitherto employed for switching service, bids were called for the proposed electrical equipment. The General Electric company responded, offering to fully equip one car, operate it for 30 days and at the end of that time, if the results were not satisfactory, to restore the car to its original condition and bear the cost of the experiment.

If the general plan adopted at first proves economical as well as satisfactory, a certain number of cars will be equipped with four motors, one on each axle. These cars are to be known as motor cars, and each will remain with its own train at all times, switching it from the incoming to the outgoing tracks and pulling or pushing it over the tilting sheaves, when the grips will take up the cable and the motors cease work. Should the grips slip while the train is mounting the 3.78 grade, the motors can come again into requisition and assist the trains over the summit. Moreover, during the early morning hours, when traffic has become light and the cable is no longer running, the trains can be operated entirely by motor cars, as they now are by the locomotives. The eventual outcome will probably be the exclusive operation of the Bridge railroad by these motor cars. Meanwhile they will switch the trains, and as each train is equipped with its own switching power—the motor car—all the interference which the steam locomotives have hitherto placed in the way of the incoming and outgoing trains will be done away with, and the complexity of the switching be greatly reduced. At present, the time consumed in switching a train is 20 seconds, and in that time a large number of people gather on the platforms. With the new motor and the new principle of operation it is expected that passengers will at all times have cars waiting for them. Beside the gain in time in the switching process, all the inconveniences of the locomotives—the noise, smoke, steam and gases—will be eliminated, and this in itself will be no small gain

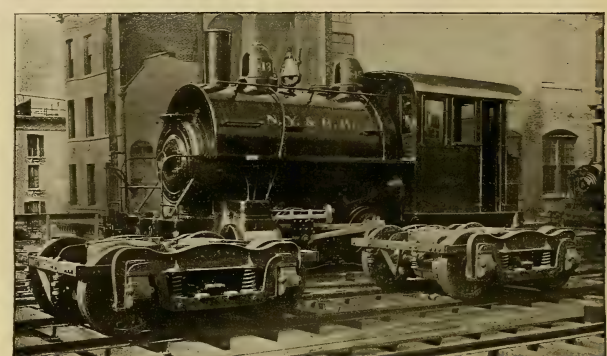


FIG. 2. ELECTRIC TRACTION ON THE BROOKLYN BRIDGE.—MOTOR TRUCKS.

Car. No. 76, Fig. 1, one of the regular passenger cars of the Brooklyn bridge, was selected to receive the first electrical equipment. All the apparatus, with the exception of the controlling handles and circuit breakers, will be placed out of sight beneath the floor of the car. The ordinary light Pullman trucks on which it has hitherto run and the cable grip mechanism were removed. Heavier trucks were necessary to carry the motors. These were supplied by the McGuire company of Chicago and combine the best features of the passenger and locomotive truck. They are shown in Fig. 2.

The general character of the motor equipment is similar to that in use on the Chicago Elevated and Nantasket Beach roads. The motors, Fig. 3, are known as the G. E. 1,200, from the fact that under normal conditions each will exert a horizontal effort of 1,200 pounds when mounted on a 33 inch wheel. Four of these motors are employed, one to each axle or two to each truck. They are completely incased and are water and dust-tight. The armatures are of the well-known iron-clad type, the windings being sunk into slots in the armature core. The Eickemeyer winding is used on the armature. By this method the crossing of two wires of large difference of potential is avoided. The insulation is substantial and each segment of the commutator is of hard drawn copper. The armature is mounted on a sleeve keyed to the shaft, which may be withdrawn without interfering with the armature structure. The field frame is of cast-steel. The ratio of reduction between the armature shaft pinion and the wheel gear is 3.5 to one.

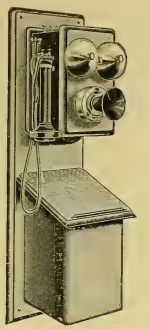
Each motor weighs about 3,000 pounds. With this equipment and the regular train a speed of about 15 miles an hour may be obtained. Each motor is suspended on the truck from two trunnions in the upper field set in two bars, the outer ends of the bar resting on elliptical springs. The axle is thus relieved of nearly all the weight of the motor. At the base of each motor, facing

FIG. 1. ELECTRIC TRACTION ON THE BROOKLYN BRIDGE.—ORDINARY BRIDGE CAR ELECTRICALLY EQUIPPED.

the ends of the car, is a small roller which depresses the cable and allows it to pass the motor without injury, while a long iron bar runs beneath the truck and depresses the tilting sheaves, preventing them from striking the motor.

The operation of the motors is controlled by series parallel controllers of the L-4 type, which have given such general satisfaction on the Chicago roads. The indicating dial of the controller is placed at the top of the platform rail and is lettered "series," "multiple" and "off," showing exactly the position of the controller itself. The reversing handle is a jointed handle, which can be placed on or taken off the reversing switch spindle only when the controller handle points to the "off" position, showing that there is no current in the motors at that moment. The controller itself has no effect until the long arm of this jointed handle is dropped into the "forward" or "reversing" notches in the reversing handle plate. There are two controllers, each operated from its own platform, and either controller will operate the four motors or any two of them, as may be desired.

The resistances as well as the magnetic cut-outs are



NORTHWEST ENGINEERING COMPANY'S TELEPHONE.

also placed beneath the car floor. Beneath each hood of the car is an automatic circuit breaker, placed within easy reach of the motorman. The operation of this device is instantaneous and is an effectual safeguard against any accident to the motor. These circuit breakers take the place of the main circuit hood switches, but are wired in multiple with each other instead of in series. To guard against any possibility of one being closed while the motorman is at the other end of the car and desires to open his main circuit, only one handle is provided. The handle cannot be taken off without opening the circuit breaker, and when removed the circuit is locked open. As the motorman must take the controller and circuit breaker handles with him when changing ends, all danger of complication is avoided.

The car is equipped with 12 electric heaters, manufactured by the Consolidated Car Heating company of

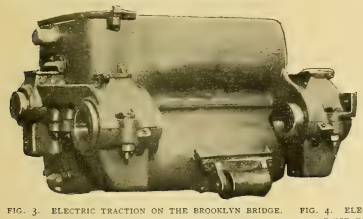
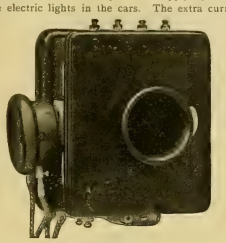


FIG. 3. ELECTRIC TRACTION ON THE BROOKLYN BRIDGE. —TYPE OF MOTOR USED.

Albany, N. Y. This system of heating has been extensively adopted on the surface cars in the city of Brooklyn, and the consequent abolition of the objectionable stove has caused a general feeling of relief. The heaters consist of a slab of porcelain in front of which is a cylinder of porcelain wound with galvanized iron wire. These heaters have a maximum capacity of 40 square feet radiating surface at 400 degrees Fahrenheit. Five different temperatures, to suit the weather, can be obtained by means of a controlling switch.

The collector, Fig. 4, which takes the current from the overhead wire, is a diamond shaped frame of metal set longitudinally upon the roof of the car and carrying at right angles a bar in the center of which is a roller. The arms are wide enough to preclude any possibility of missing contact. The diamond frame is depressible and expansible, on the principle of the pantograph, allowing a play up and down to conform to the varying heights of the overhead wire. With this collector the trouble of reversing is entirely done away with.

The power to run the cars will be taken from the overhead wire, already in position, supplying current to the electric lights in the cars. The extra current,



PARTY-LINE TELEPHONE.

however, will be supplied from the Fulton street feeder of the Kent avenue station of the Brooklyn City railway, the return wire being connected to the rails of the surface road.

On February 8th the first official exhibition of the system was given in the presence of President Howell, Vice-president J. Seaver Page and Trustees Keeney and Henriques. The motor car was coupled to three of the ordinary passenger cars, and the complete train of four cars was switched by the motors from the incoming to outgoing platforms and thence to the cable sheaves several times. The car was then taken over the complete bridge circuit twice. Complete satisfaction was expressed by the president and trustees and by Chief Engineer C. C. Martin, at the manner in which the work was performed. In addition to those named there were present ex-Mayor Charles A. Schieren, E. R. Knowles, K. L. Martin, Elisha Dyer, Jr., of the Brooklyn elevated railroad; H. M. Littel, president of the Atlantic Avenue electric railway; Dennis Sullivan, president Coney Island & Brooklyn steam railroad; F. B. Scott and F. H. H. Sheppard of the Baltimore & Ohio railroad; Major G. W. McNulty; A. C. Vosburgh of the Raw Hide Pinion company; W. J. Clark, A. K. Baylor, C. B. Martin, R. H. Beach and F. Gilbert of the General Electric company; E. E. Higgins, *Street Railway Journal;* W. F. Osborne, WESTERN ELECTRICIAN; C. W. Price, *Electrical Review*.

## Party-line Telephone.

The telephone herewith illustrated is known as "Outfit No. 20" by the manufacturer, the Connecticut Telephone & Electric company of Meriden, Conn. It has a

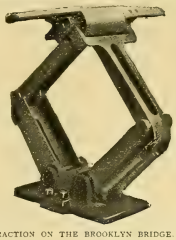


FIG. 4. ELECTRIC TRACTION ON THE BROOKLYN BRIDGE. —DEVICE FOR TAKING CURRENT FROM OVERHEAD WIRE.

series battery call, and is put on the market as a first-class low priced instrument not requiring the services of an experienced electrician to set it up. From two to 10 or more of these instruments with from one to three cells of battery at each station can be run in series on one line, thus doing away with a complicated system of wiring. This set gives excellent satisfaction on short lines, as the resistance of each set is very low.

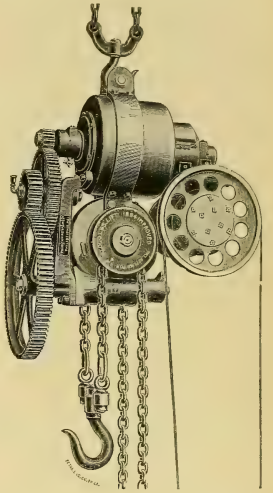
This telephone is guaranteed to be free from infringements, and equal in workmanship and speaking qualities to any telephone on the market.

## Northwest Engineering Company's Telephone.

The new telephone herewith illustrated has lately been placed on the market by the Northwest Engineering company of St. Paul, Minn. It has many points of merit. The transmitter is of the improved Hunnings type, using Bildhauser coke imported from Germany. The instrument is handsome in appearance and well made. It is confidently recommended as a reliable telephone.

## Combined Harrington Hoist and Electric Motor.

The application of electricity to the Harrington hoist marks a noteworthy epoch in the history of hoisting machinery. The electric crane has a large and increasing field of usefulness, but the crane has only a limited area under its control, while the electric portable hoist makes it possible to apply the power of electricity in many places where the crane cannot be used. With this new combination there is a saving of two-thirds the labor required to lift 6,000 pounds or 8,000 pounds by the hand power hoist. Ten thousand pounds can be lifted with great ease, and with a saving of three-quarters of the



COMBINED HARRINGTON HOIST AND ELECTRIC MOTOR.

labor, while the gain in time is as five to one; that is, 10,000 pounds can be raised at a maximum speed of 5½ feet and lowered at the rate of 10 feet per minute. Smaller loads can be raised faster. By means of a controller, operated by the rope shown on the right of the cut, the operator can vary the speed as he may desire, within these limits. By this controller, also, the action of the motor is started, reversed, or stopped.

A Storey motor is used, and the electrical features were described and illustrated in a recent issue of this journal. Edwin Harrington, Son & Co. of Philadelphia are the makers of this hoist, and they are to be congratulated on producing a very neat and effective machine.

## Chicago Electrical Association.

The last paper of the present series before the Chicago Electrical association will be presented on Friday evening, February 21st, by Bertrand S. Summers on the "Outlook for Electro-chemistry." The attendance at this course of lectures has been very gratifying to the officers of the organization and they are very much encouraged by the interest manifested. The series will be followed by another course, and the topics to be discussed at this time and the dates of the lectures, as well as the authors who will read papers, will soon be announced. This course will extend through March, April and May.

## Philadelphia Lighting Situation.

Professor William D. Marks, late president of the Edison Electric Light company of Philadelphia, is greatly opposed to the leasing of the company's property to the new, comprehensive Pennsylvania Heat, Light & Power company, which seems to be endeavoring to secure a monopoly of the electric lighting business of Philadelphia. Prof. Marks was defeated as a candidate for re-election to the presidency of the company recently and Charles M. Swain was chosen in his stead. He was, however, elected a director, but tendered his resignation, and thus withdrew entirely from the management of the company. In a letter which Prof. Marks has issued to his friends in the company, he says, after expressing his thanks for their confidence in his management: "This ends my connection with the company, the object of my unceasing thought and labor for many years. At my personal expense and for my guidance in protecting your interests, I have procured the opinion of Theodore F. Jenkins and George Tucker Bispham, who most emphatically state that any lease of our property and franchises will be illegal, no matter what ordinances councils may enact." It is said that President Marks received a salary of $15,000 a year.

The question as to whether a lease will be effected to the Pennsylvania Heat, Light & Power company is one of future consideration; but if at any time the directors are advised that it can legally be done, a stock vote will be taken on 60 days' notice to the shareholders. In the meantime Mayor Warwick has vetoed the bill of councils which was intended to enable the various electric light companies to lease their wires and conduits to one company, presumably the Pennsylvania Heat, Light & Power company. A number of men prominent in business, professional and other pursuits are connected with the company, and strong pressure was brought to have the mayor approve the work done by councils in passing the measure. So strong was the opposition to it that Mayor Warwick granted a public hearing, receiving the statements of both sides to the controversy. The advocates of the measure urged that if the bill became a law the streets would not be torn up and the citizens would be spared the annoyances associated with that work. On the other hand, those who objected said that the granting of the privileges sought would be the means of creating a monopoly in the electric lighting business. The mayor weighed both arguments for a week and finally returned the bill with a veto.

## Interesting Rumor from Niagara Falls.

There is a possibility that there may be a very notable change in the installation of the seven additional dynamos soon to be placed in the plant of the Niagara Falls Power company. When Secretary William B. Rankine was in the city of Niagara Falls a few days ago, he stated that there would be a slight delay in letting the contract for the extension of the wheel-pit and power house, owing to the fact that the company is considering a proposed change of plan for the installation of the dynamos. The two 5,000 horse power generators now at work are connected to the turbines in the wheel-pit by a steel tube 166 feet long, which is 38 inches in diameter, except at points where it passes the journal bearings or guides, at which it is 11 inches in diameter and solid. Now, it is understood, if the electrical companies can guarantee the efficiency of the dynamos if placed at the bottom of the wheel-pit, the additional generators will be placed there. This will be a startling innovation indeed; however, if practicable, it would be a very economical method, for it would result in dispensing with the expensive shafts which now extend up through the wheel-pit. This important question will be decided as soon as possible, and after it is settled the work of the extension will be rapidly proceeded with.

## Litigation over Booster Patent.

On Monday, February 10th, a bill was filed by the Siemens & Halske Electric company of America against the Toledo Traction company and Albion E. Lang, president of that company, upon the so-called booster patent, No. 417,668, issued December 17, 1889. This is the first suit brought upon the very important patent, which covers the direct current booster, which has gone into quite extensive use already, and the use of which will be more extensive as electric lighting and power circuits are more extended. This patent is looked upon by its owner as a fundamental one, and the interest in the litigation just begun will be general among those engaged in electrical pursuits.

# CORRESPONDENCE.

## New York Notes.

New York, February 8.—The strike at the Manhattan Hotel against the employment of electrical workers who are not represented in the Board of Walking Delegates has excited some attention. These electrical workers belong to Local Assembly No. 5 of the National Brotherhood, lately organized, and which Electrical Workers' Union No. 3 declares to be formed of delinquent union men who formerly took the places of strikers. The contractors refuse to take back the men of Union No. 3. A representative of one of the largest firms in the business said: "The contractors are in favor of organized labor, but they will not have anything to do with Union No. 3, as it has broken its agreement with them. The contractors are now depending on Union No. 5 to furnish them with all the union men they want."

Edwards & Co.'s Electrical Works, in One Hundred and Forty-fourth street, near the cut of the New York Central railroad, were almost entirely destroyed by a fire which started in the engine room at eight o'clock on Tuesday night. All that was saved was the shell of the factory. All of the floors were burned through, and the machinery and stock, which were valued at $25,000, were destroyed. Before the fire reached the north end of the building Robert Edwards succeeded in taking a number of valuable papers from the safe in the office. The police made an investigation as to the origin of the fire, and concluded that it was caused by spontaneous combustion in the varnish-room, where several hundred gallons of oil and varnish were stored. The building and stock were insured for $15,000.

At the recent annual meeting of the Electricity Newspaper company of New York city, these officers were elected for the ensuing year: Edward Weston, president; A. M. Aich, treasurer, and L. J. Montgomery, secretary.

One of the most instructive exhibits at the forthcoming Electrical Exposition is promised by the Edison Electric Illuminating company of New York. This display will occupy a space of over 1,000 square feet, and will comprise a complete demonstration of the applications of electricity for domestic purposes. The most improved methods of house lighting will be shown in detail, and electric heating, also cooking by electricity. This will be the first time that such a practical exhibition of the many uses to which electricity can be applied in the home has been made, and the understanding of the visitor will be further enlightened by a well arranged display of the various kinds of apparatus employed, all of which will be explained by those in charge of the exhibit.

W. F. O.

## Washington, D. C.

Washington, February 7.—A bill has been introduced by Mr. Frye in the Senate relating to the requirements of vessels propelled by electric motors. It requires all vessels above 15 tons burden carrying freight or passengers for hire and propelled by such motors to be made subject to all of the provisions of the Revised Statutes of the United States relating to the inspection of hulls and boilers and requiring engineers and pilots, and that all vessels so propelled, without regard to tonnage or use, shall be subject to the same regulations as steam vessels in passing each other, and also subject to such provisions relating to lights, fore signals, steering and sailing rules as the board of supervising inspectors shall, by their regulations, deem applicable and practicable for their safe navigation.

The scramble of proposed telephone companies for a franchise to operate in Washington is getting interesting. Three companies are knocking at the door for an opportunity to divide the business with the local company. They are the Standard, the Home and the Columbia. Since the commissioners reported adversely upon the general proposition to charter another telephone company, the would-be competitors have been uneasy. Several hearings have been held, with a view to a reconsideration, but up to this time the commissioners have not indicated a disposition to change their action.

Chief Justice Bingham, in delivering an opinion on the Potomac Electric Light case, recently argued before him, denied the right of the commissioners to grant the permits authorizing that company to connect Georgetown with Eckington by an overhead electric line, and he based his decision upon the fundamental principle that such concession of public ways for private uses can only be made by the commissioners under specific directions from Congress. Justice Bingham said, in effect, that the commissioners have no more right to authorize the construction of the electric light lines proposed by the Potomac company than they have to authorize the Tenleytown Railroad company to build a street car line over the same route. In concluding his opinion Judge Bingham adverted to the importance of the matter. He said it was of the utmost moment that it should be fully determined just what powers the commissioners have in permitting the occupancy of the streets, in allowing poles or other obstructions to be erected, or having the streets dug up for laying pipes or poles. In his view they had not primary authority to authorize any ofthese things. They must have the sanction in each case of a special act of Congress. The Potomac Light company's permit from the commissioners is, therefore, rendered valueless by Justice Bingham's decision.

T. M.

## PERSONAL.

At a meeting of the directors of the Interior Conduit & Insulation company of New York, held February 1st, Allan C. Bakewell was elected vice-president and general manager in place of E. W. Little, resigned.

John W. Mackay, Jr., who was killed by a fall from a horse near Paris on October 19, 1895, was buried on Sunday, February 2d, at Greenwood cemetery, Brooklyn. His body was brought to this country on the French line steamer La Touraine. The father, mother and brother of the deceased accompanied the body. They were met on their arrival at New York by George G. Ward of the Postal Telegraph-cable company, and the funeral services, which were held immediately after their arrival, were attended by only a few intimate friends.

## ELECTRIC LIGHTING.

The Norfolk, Neb., Electric Light & Power company has leased its plant to H. H. Patterson for a period of five years, beginning February 1st.

It is possible that the Gas, Electric Light & Power company and the Electric Light & Street Railway company of Wichita, Kas., may be consolidated.

The stockholders of the Chester, Pa., Electric Light company have voted to increase the bonded indebtedness of the company from $35,000 to $100,000. This is done in order to cover the erection of the company's new plant.

The Tradesmen's Bank building, a large and handsome block now being erected in Pittsburg, will be lighted by electricity from its own plant, which consists of Ball engines built by the Ball Engine company, Erie, Pa., directly connected to Westinghouse dynamos.

The Wapello Light & Power company of Wapello, Iowa, has been incorporated with a capital stock of $7,000. A plant having a capacity of 30 arc and 1,200 incandescent lights will be put in. The officers of the new company are: President, Jonas Miller; vice-president and manager, W. H. Prescott; secretary, Mr. Ong; treasurer, D. C. Thomas. In addition to those named, W. S. Isett is a director.

## ELECTRIC RAILWAYS.

The Yonkers, N. Y., Electric Railroad company is having plans prepared for a two-story brick power house, repair shop and carhouse in Buena Vista avenue, near Main street, to cost about $40,000.

"Tom Johnson may drop his fares as low as he pleases," Ford Starring, of the Detroit railway, is reported to have said, "but the Detroit railway will proceed as it now is. We have no idea of attempting to carry on an expensive gift show just to play tag with Tom Johnson. There will be no war of rates so far as we are concerned."

The Chicago General Railway company, noted for its fine rolling stock, has purchased five new cars of exceptional size and finish. The cars are 40 feet long, with five-foot vestibules at each end, and are said to provide seating capacity for 44 persons, with a total carrying capacity of 100. Each car has two four-wheeled trucks and two 50 horse power motors, and is equipped with the Sperry electric brake. The interior finish is white-oak, with brass trimmings.

The amounts of taxes paid into the city treasury of St. Louis by the street railway companies in 1895 was as follows: Cass Avenue & Fair Grounds, $10,966.47; Citizens', $5,764.39; Compton Heights, Union Depot & Merchants' Terminal, $3,171.35; Jefferson Avenue, $1,101.67; Lindell Avenue, $12,616.11; Missouri, $12,760.11; People's, $3,134.45; People's (leasehold), $537.10; St. Louis, $11,982.66; St. Louis and Suburban, $5,454.45; Southern, $5,287.77; Union Depot, $14,552.54.

## TELEPHONE.

At Des Moines, Iowa, January 30th, a meeting of telephone users was held to organize a new company to own a co-operative exchange. It was claimed that an exchange of 1,500 instruments could be provided with service at $12 per year for business houses and $10 for residences. The promoters submitted specifications for the exchange and the meeting was satisfied that the plan was feasible. A committee was named to prepare articles of incorporation and call a public meeting

## TRADE NEWS.

Antoine Bournonville of the Alfred F. Moore company of Philadelphia was in New York on Saturday—his first visit for several months. He reports that rushing business has confined him closely to Philadelphia.

The Storey motor of the Storey Motor & Tool company of Philadelphia is being pushed intelligently and persistently and is rapidly coming into prominence. A recent descriptive pamphlet, which will be sent on application, tells all about it and its applications.

Condensed information in readable shape is given in the new "Catechism on Oil Filtration," issued by the Purity Oil Filter company of 211 Water street, Pittsburg. This booklet essays to show how the consumer can save from 50 to 90 per cent. of his oil expense by the use of the company's oil-saving device.

The American Carbon company of Noblesville, Ind., through Secretary Edmund Dickey, has just closed a contract for three years with the Badger Illuminating company for the latter's supply of carbons. Previous to this time the company had a year's contract, and the signing of this new arrangement is a tribute to the excellence and reliability of American goods.

The Crown Woven Wire Brush company, Salem, Mass., reports a steady demand for its brushes, especially for the new brush, the Crown "K," which is the only brush of its kind made in America. H. B. Cohn & Co., 203 Broadway, New York, are the New York agents. At present the company has no agent in Chicago, but it hopes soon to enter into an arrangement by which one of the largest dealers will carry a stock of these goods.

The Standard Telephone & Electric company of Madison, Wis., has been awarded the contract for 1,000 telephones and a 200 plug switchboard for the new exchange at Portland, Ore.; also for 500 telephones and switchboard for Jacksonville, Fla., and for 700 telephones and switchboard for San Jose, Cal. The California Telephone & Construction company of San Francisco, Cal., has also contracted for the exclusive use of the Standard company's telephones and switchboards in California for a period of four years.

Exhaustive circulars of information and books of testimonials from students are issued by the International Correspondence Schools of Scranton, Pa., and will be found valuable by all young men desiring to advance themselves in technical pursuits by home study. The *American Artisan* says of this institution: "The faculty compare favorably in scholarship and character with those of technical institutions everywhere. The progress of students has been as marked here as anywhere. The Correspondence School counts among her graduates leaders in industrial circles everywhere. This school lacks only three of the features of our technical colleges—the students are too far apart to haze one another, formulate a college yell, or organize a football eleven." Courses known as "Complete Electrical," "Electrical Power and Lighting" and "Mechanical-electrical" are provided.

F. H. Ball has sold his interest and retired from active participation in the management of the Ball & Wood company of Elizabeth. Mr. Ball has been one of the officers of this company for a number of years, and desires to take up actively the profession of consulting engineer and mechanical expert, in which capacity he will still be connected with the company, and his son, Bert C. Ball, also remains at the head of the draughting department. The business of the Ball & Wood company has been excellent during the last year, and has extended largely through the West since its Chicago office was opened a year ago. At present its shops are very busy executing the contract for a number of large engines for the Edison Electric Illuminating company of Paterson, and also orders for the New York and Brooklyn Bridge; Johnston Building, New York; Ellicott Square Building, Buffalo; St. Charles Hotel, New Orleans, and others.

General Manager E. C. Wilcox of the Connecticut Telephone & Electric company of Meriden, Conn., says that his company's business for January exceeded several times that of any previous month, and the prospects are that they will have all they can do to fill orders now booked for telephones. Recent sales have been to the New York, New Haven & Hartford Railroad company; Delaware & Hudson Canal company, Albany, N. Y.; Cincinnati, New Orleans & Texas Pacific Railway company; Cudahy Packing company, South Omaha, Neb.; George H. Hammond company, South Omaha, Neb.; Searles Manufacturing company, Newark, N. J.; Westinghouse Electric & Manufacturing company, Pittsburg; Broad Brook company, Broad Brook, Conn.; Stanley Works, New Britain, Conn.; Central Railway & Electric company, New Britain, Conn.; Hartford Street Railway company, Hartford, Conn.; Seneca Light & Power company, Seneca Falls, N. Y.; Perry Telephone company, Perry, Ia.; Juneau Telephone company, Juneau, Alaska.

## BUSINESS.

Capt. Candee of the Okonite company of New York was in Chicago last week.

S. D. Kopf of the Furniture City Electric company, Grand Rapids, Mich., visited friends in Chicago during the last week.

The Union Heater Supply company of Detroit, Mich., calls attention to its complete line of linemen's fire-pots and portable forges for electricians. Detailed information is cheerfully furnished.

The Jewell Belting company of Hartford, Conn., has just issued a pamphlet descriptive of its pulley covering material. The company will gladly supply copies of this little book to engineers of power or lighting stations who will apply for it.

The Emerson Electric Manufacturing company of St. Louis has just issued a small pamphlet descriptive of its new alternating current power motors. This little book gives, in addition to a complete table of sizes, frequencies, dimensions, etc., some interesting information about motors of this class, "power factor" of motors and valuable information in relation to installing. It should be in the hands of everyone interested in alternating current motors.

The Electric Appliance company, Chicago, has just prepared a special catalalogue of the "Paiste" specialties, listing a complete line of Knife switches, Porcelain sockets, cut-outs, etc., together with a special net price-list on these goods. This catalogue will be sent on application. It makes quite a valuable list for reference, as considerable of the material has not been previously catalogued.

The Northwest Engineering company of St. Paul, Minn., carries on a large manufacturing and supply business and installs electric light and telephone plants; its methods of construction have become a standard in the Northwest. It has just completed an iron armored installation in the United States custom house at Mankato, Minn., on which it received a high testimonial from the United States government. The engineering and manufacturing departments are conducted on a most systematic basis, which enables them to maintain the high standard of excellence and at the same time reduce the cost of production to the lowest possible point.

H. E. Collins & Co., Pittsburg, Pa., sole sales agents for the Cahall vertical water-tube boiler, manufactured by the Aultman & Taylor Machinery company, Mansfield, Ohio, report the following recent sales of Cahall boilers: National Chemical company, Cleveland, 150 horse power; Republic Iron Works, Pittsburg (fourth order), 250 horse power; municipal electric lighting plant, Longton, Ohio, 250 horse power; Voight Brewing company, Detroit, Mich., 500 horse power; Michigan Alkali company, Wyandotte, Mich. (fourth order), 300 horse power; Jefferson Coal company, Coal Glen, Pa., 500 horse power; Ohio Iron company, Zanesville, Ohio, 500 horse power. The boilers for the Republic Iron Works are for the utilization of waste heat from heating furnaces; those for the Ohio Iron company are for blast furnace gas, and the other orders mentioned are for boilers of the direct-fired type.

H. O. Woodruff and L. G. Nilson, the moving spirits of the Sioux City (Iowa) Electrical Supply company, have been very successful. The Nilson-Woodruff company has now been incorporated and has purchased the plant of the Rathbun Manufacturing company, which is claimed to be one of the best equipped machine shops in the Northwest. This building will now be used as a machine shop by the Sioux City Brass Works, and two buildings will be erected at once, one for the plating department and pattern-making and one for the foundry. Next summer it is the intention to build a three-story building on the east half of the lot property, which will be occupied by the Sioux City Electrical Supply company. The Supply company, besides doing construction work and jobbing electrical goods, manufactures a line of small supplies, such as telephones, lamp sockets and chandeliers. The Brass Works are building heavier electrical machinery, such as dynamos and motors, and doing fine machine and model work.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued February 4, 1896.*

553,831. Secondary Battery. Anthelme E. W. Boucher, Prilly, Switzerland. Application filed August 13, 1895.

An electric couple for storage batteries is described, consisting of an anode, comprising one or more thin sheets of non-oxidizable precious metal, the entire perimeter of which is inclosed in a metallic frame adapted to conduct the current to the perimeter of the anode, the frame protected by a layer of insulating material from the electrolyte, and a cathode of non-precious metal surrounding the insulated frame of the anode, and supported by the frame at an invariable distance from the anode.

553,838. Successive Non-interference Signal Box. Frederick W. Cole, Newton, Mass. Application filed April 21, 1890.

In this device a signaling train and a pull are combined with a variable stopping device for the train, comprising a controlling detent for the train, a holder for it, and a restoring device for the holder under the control of the armature of the non-interference magnet.

553,839. Non-interference Signal Box. Frederick W. Cole, Newton, Mass. Application filed March 7, 1891.

In a non-interference signal box there is a signaling mechanism with a non-interference magnet, and its armature is adapted to move out of the field of force. There are a signal-controller governed by the armature and a stopping device for the train, one of the co-operating members of which is governed by the armature, and a restoring device operated by the train in running for restoring the armature re.

553,840. Successive Non-interference Signal Box. Frederick W. Cole, Newton, Mass. Application filed May 3, 1890.

The last claim is for a non-interference signal box, a train, a controller for the signaling circuit operated by it, a non-interference magnet and its armature combined with a shunt switch for the circuit controller controlled by the train in running, which is set at the beginning of a round, and a shunt switch for the magnet, the closing of which is controlled by the magnet, and means independent of the action of the magnet for opening the last named shunt switch.

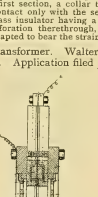
553,843. Telephone. Samuel A. Dinsmore, Chicago, Ill. Application filed March 8, 1895.

The cut shows a telephone containing a transmitter, consisting in part of granulated carbon, in which there are a carbon agitating mechanism with a call-bell operating mechanism containing a magneto generator, and connections from such call-bell operating mechanism to the carbon agitating mechanism, so that when the former is operated the latter is set in motion.

553,844. Insulating Joint. William O. Duntley, St. Louis, Mo. Application filed May 25, 1895.

In an insulating joint the combination is claimed of a section adapted to be secured to the gas pipe, a cone at the lower end of the perforation therethrough, a second section insulated from the first section, a collar to secure the two sections, but in contact only with the second section insulator, interior glass insulator having a drip-cone at the bottom of the perforation therethrough, and fibrous insulating washers adapted to bear the strain of the parts.

553,847. Electric Transformer. Walter K. Freeman, Fort Wayne, Ind. Application filed July 5, 1895.



NO. 553,831.

The last claim is given: In an inductorium, the combination with the oppositely arranged co-operating plates, each having end and intermediate arms of sufficient length to bridge the space between the bodies of the plates, each of said end arms having inclined edges for mutual co-operation, and the intermediate arms having reduced ends and bearing surfaces arranged at an equal inclination to the inclined surfaces on the end arms, whereby the plates may be joined in solid sections adapted to be inserted or removed for the renewal, repair or inspection of the coils.

553,857. Electric Light Switch. Harry W. Lawrence, Denver, Colo. Application filed April 1, 1895.

In a three-way switch the non-conductive ratchet wheel is revolubly mounted in a suitable base, and provided with three circular divisions of teeth separated by collars, each alternate tooth of each end division intermediate of the teeth of the opposite end provided with a conductive polepiece passing through the collar adjacent to its end.

553,873. Non-interfering Signal Apparatus. John J. Ruddick, Richmond, Ind. Application filed June 28, 1890.

The features of this invention are a motor, means for operating it, a retarded operative device consisting of a signal wheel moved by the train to operate the circuit for its first time after the train has run a longer time than the longest closure in any signal, and a determining device comprising a non-interference magnet, its armature, and a shunt lever governed by it, which is free to act during the lapse of time for operation of the retarding signal being sent.

553,890. Electric Programme Clock. Herman T. R. Zeidler, Berlin, Germany. Application filed June 29, 1895.

The combination is claimed with a slidable shaft, a wheel provided with a notched flange and revolved from the shaft, and a lever for sliding the shaft, the lever being provided with a hooked end engaging with the flange, of an electromagnet arranged behind the lever, and operating to retract its hooked end through the notch in the flange.

553,900. Electrical Whistle Controlling Device. Arthur E. Colgate, New York, N. Y. Application filed November 24, 1894.

There is the combination of a whistle, a whistle-operating magnet and circuit, an automatic circuit-maker for operating the whistle at intervals, and means always in condition to act connected to the circuit for both throwing the automatic circuit-maker out of use (when in use) and for sounding the whistle at will.

553,901. Automatic Current Regulator. Stanley C. C. Currie, New York, N. Y. Application filed February 20, 1895.

A circuit embracing a secondary battery, a resistance device for controlling the amount of current passing through the circuit, and means comprising an expansion rod for varying the resistance offered to the current.

553,911. Regulating Socket for Incandescent Lamps. Alvin B. Hendricks, St. Mary's, Ill. Application filed June 19, 1895.

The device consists of a socket to receive the lamps, a hub provided with radially extending coils of varying resistances, and stationary contact fingers arranged to close the circuit successively through the resistance coils as they are revolved.

553,919. Electric Arc Lighting. George R. Lean, Cleveland, Ohio. Application filed September 26, 1895.

A multiple arc circuit is supplied with a current of constant potential; two or more asc electrical lamps are included in series in the multiple arc circuit, each of the lamps being provided with a main or lifting magnet which is included in series with the arc, and also provided with a resistance included in a circuit shunting the arc and the magnet.

553,920. Electric Arc Lighting System. George R. Lean, Cleveland, Ohio. Application filed September 27, 1895.

With two or more arc lamps, each having a carbon separating and feeding magnet, there is a resistance included in the shunt circuit between the terminals of each lamp, each resistance coil being adapted to compensate for increase in voltage of the arc of the lamp, between the terminals of which it is connected, and a reverse winding on the magnet of each lamp included in series with said resistance coil.

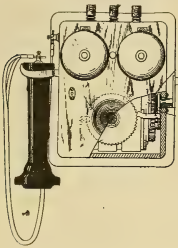
553,921. Electric Arc Lighting. George R. Lean, Cleveland, Ohio. Application filed September 27, 1895.

In this arrangement there are a multiple arc circuit, two or more arc lamps, each having a separating and feeding magnet, included in series therein, a magnet or solenoid included in a shunt circuit between the terminals of each lamp, the coil of each shunt magnet or solenoid being adapted to compensate for increase in voltage of the arc of the lamp between the terminals of which it is connected, contacts connected with the terminals of the separating and feeding magnet of each lamp, and an armature for the shunt magnet or solenoid adapted to engage the contacts and short-circuit the separating and feeding magnet when the voltage of the arc increases, whereby increase of voltage of the arc of one lamp will not affect other lamps in the same multiple arc circuit.

553,923. Apparatus for Electric Welding. Hermann Lemp, Lynn, Mass. Application filed June 17, 1891.

In an electric metal-working apparatus there are two transformers supplying heating currents to the same work, alternating current sources connected respectively to the primaries of the transformers, and adapted to supply alternating currents of different frequency.

553,927. Electric Trolley. Nelson Muslar, West Boylston, Mass. Application filed April 9, 1894.



NO. 553,843.

A central spindle is held from rotation; a cylindrical block is held on the spindle, and is capable of a laterally rocking motion, and a grooved wheel rotating around the block, whereby the wheel is capable of being inclined from a vertical plane.

553,952. Electric Railway. Augost Casazza, Hoboken, N. J. Application filed December 13, 1894.

One claim is for the combination with the electrically operated switch, the trolley and the line wire, of the spring-pressed plates on the trolley arms, the conducting strips opposite the plate, and an electric circuit including a generator, the contact plates, the conducting strips, and the electrically operated switch.

553,957. Telegraphy. Patrick B. Delany, South Orange, N. J. Application filed July 25, 1891.

This system includes a main line, a source of electrical energy for signaling, a transmitter controlling contacts normally connecting the main line to earth, contacts controlled by the transmitter for sending signals into the main line, other contacts controlled by the transmitter for locally actuating a relay, an electro-magnetic instrument actuated by the relay, and contacts controlled by said electro-magnetic instrument for connecting the main line to earth each time that a signal is transmitted.

553,960. Electrical Igniting Device. Wilhelm Kaiser, Vienna, Austria-Hungary. Application filed September 6, 1895.

The last claim follows: In an electric igniting device, the combination of a base, posts rising from the base, points carried by the posts, means for creating a spark between the contiguous ends of the points, parallel guides arranged upon the base between the posts, a stop at one end of the guides, and the slide arranged between the guides and carrying a candle, lamp or other device adapted to be ignited by the electric spark created between the points.

553,961. Registering Apparatus for Telephones. Franz Quatram, Pankow, Germany. Application filed July 26, 1895.

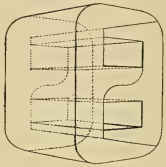
A commutator is in circuit with the battery, and a registering device is actuated by the commutator. There are also an electromagnet, in circuit with the commutator and with the telephone, a switch for breaking and closing the circuit between the commutator and the electromagnet, and a magnetic switch [illegible], actuated by the electromagnet, for breaking and [illegible] the circuit between the electromagnet and the telephone.

553,965. Electrician's Screw Driver. Joseph Reece, Pulaski, N. Y. Application filed May 31, 1895.

The feature of the tool is a handle composed of material which is a non-conductor of electricity and formed with an annular pocket adapted to have a supply of wire wound around the same; the screw-driver shank is permanently embedded in this handle, and a removable inclosing shell or case is composed of material similar to the handle and adapted to be applied and locked thereto.

553,977. Adjusting Attachment for Telephone Signal Bells. Cleveland F. Dunderdale, Chicago, Ill. Application filed June 27, 1895.

The claim: An adjusting attachment for telephone signal bells consisting of a holding member comprised of two separable parts, overlapping each other and slidably held upon the telephone box until the proper adjustment is effected, bell gongs held and carried by said separate parts, a bell-striker between said gongs, said separate parts being capable of lateral sliding movements carrying the gongs toward or away from the striker in order to effect the proper adjustment, and means for holding the two separable parts permanently upon the telephone box and thus maintain the bell-gongs securely and immovably in an adjusted position relative to the bell-striker.



NO. 553,847.

553,979. Electric Railway. Frederick C. Esmond, Brooklyn, N. Y. Application filed April 19, 1893.

One claim is for a case for magnetic circuit-closing devices, consisting of a base of insulating material, a dome shaped top of conducting material connected to the base, and a flange upon the top projecting beyond the base, supported independently thereof.

553,980. Electric Railway. Frederick C. Esmond, Brooklyn, N. Y., and Harding F. Gray, Passaic, N. J. Application filed May 4, 1893.

The combination of a hollow case having a base of insulating material, a ring of conducting material upon the outside of the base, a magnetic circuit-closing device within such case having a helix-coil in a permanently closed circuit, including an electrical connection between one terminal of such coil and the ring.

553,981. Circuit-controlling Device for Electric Railway Systems. Frederick C. Esmond, Brooklyn, N. Y. Application filed July 1, 1893.

The combination with a supply conductor and a sectional collecting rail or conductor of a switch between the supply conductor and each section of the collecting conductor, a coil or helix for closing the switch, a circuit including the coil and extending from an insulated terminal to earth, a movable lever or circuit-closer adapted to be encountered by the trolleys of a car and while so encountered to complete the circuit from the car through the helix, and a coil or helix in the circuit controlled by the switch.

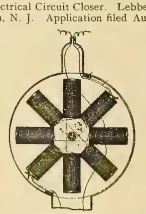
554,036. Telephone Apparatus. Carl J. Schwarze, Adrian, Mich. Application filed September 17, 1895.

Vibrating transmitting and receiving diaphragms are connected to and form respectively opposite poles of the permanent magnet; an armature is employed between the diaphragms and constitutes, in connection with the magnet and diaphragms, transmitting, receiving and signaling instrumentalities of the telephone.

554,063. Commutator for Magneto-electric Machines. John C. Henry, Westfield, N. J. Application filed March 31, 1893.

This commutator has radial arms of its alternate segments surrounded with insulation.

554,074. Electrical Circuit Closer. Lebbeus B. Miller, Elizabeth, N. J. Application filed August 3, 1895.



NO. 553,911.

The claim is reproduced: An electrical circuit-closer comprising a casing of equal width with and adapted for attachment to the parting strip of a window frame, the said casing being formed of a plate with side flanges along the edges of one of its faces having in each an aperture between the middle and one of its ends and disposed upon opposite sides of the middle of the casing, a flat switch-lever secured movably within the said casing at one edge by a pivotal pin projected from the corresponding edge of the said plate intermediate to the apertures in its side flanges and notched upon opposite edges intermediate to the middle and each end to form heads projected normally through the said apertures without the casing, and an insulated contact-point fixed to the said casing in the path of the said switch lever.

554,080. Automatic Switch. James F. McElroy, Albany, N. Y. Application filed January 2, 1892.

Two armature bars, a central pivotal connection between the bars and means for fixedly securing one of the bars, coils on both bars, laterally extending armatures on the opposite ends of the bars, those adjacent arranged to act upon each other, fixed contacts and contacts carried by the opposite ends of the movable bar.

554,083. Electric Time and Signal Recorder. Charles E. Ongley, New York, N. Y. Application filed December 8, 1893.

In a signal-recording device there is the combination of a type wheel, a signaling circuit, a magnet in the signaling-circuit for operating the type wheel, a printing and releasing circuit, a magnet in the latter circuit for printing from and releasing the type wheel, and means operated from the magnet in the signaling-circuit, for operating the printing and releasing magnet after the type wheel has been operated, whereby a record will be printed from the type wheel, after which the type wheel will be released.

554,089. Electric Carriage Lamp. Patrick H. Quinn, New York, N. Y. Application filed December 3, 1895.

A socket is provided with bottom springs, for retaining the socket in the cup or cone of the candle-holder of the lamp, a spring-cushioned lampholder is supported on the socket, means are provided for locking the socket to the cup or cone of the candle-holder, an incandescent lamp is inserted in the lampholder, and provided with the usual metallic contacts, and conducting wires attached to the lampholder and connected with the contacts of the same, the conducting wires being adapted to communicate with a suitable source of electricity.

554,097. Apparatus for Railway Signaling and Switching. John D. Taylor, Chillicothe, Ohio. Application filed October 29, 1894.

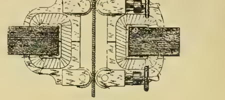
In the combination of an automatic reversing switch with switch-rails, interlocking mechanism, a magnet and pivoted armature are employed for locking a portion of such mechanism.

554,102. Underground System for Electric Railways. William P. Allen, Chicago, Ill. Application filed June 22, 1895.

An electrical conductor, which consists essentially of an inner metallic conductor, an outer metallic sheath normally disconnected from the conductor, and insulating supports at each end of the sheath, and an electrical connection through the sheath to the inner conductor.

554,103. Electric Conductor and Contact Device therefor. William P. Allen, Chicago, Ill. Application filed July 15, 1895.

An outer casing is formed in sections and the upper plates or covers are also formed in sections and insulated one from the other, the plates, being adapted to form a slotted opening in the top of the casing, are also divided into sections, and a yielding diaphragm in the casing, with insulators between the sections and contacting devices below the diaphragm, and connections from the contacting devices through the diaphragm, the connections being arranged below the slotted opening.



NO. 553,923.

554,104. Underground System for Electric Railways. William P. Allen, Chicago, Ill., and Alvaro S. Krotz, Springfield, Ohio. Application filed August 23, 1895.

The yokes and the supporting chairs, a flexible casing closed at each end as described, the casing being formed of two pieces of resilient sheet metal, one of which is bent or flanged to receive the other piece, which is bolted or otherwise secured thereto.

554,112. Telegraph Key. William Deats, Amawalk, N. Y. Application filed June 16, 1894.

There is a rotary operating knob on the transmitting key, and a circuit switch having one contact mounted upon the knob or knob-spindle, and the other on the lever is used.

554,124. Electric Battery. Charles J. Hirlimann, Fort Lee, N. J. Application filed October 25, 1895.

The combination with a jar having interior flanges, and a zinc element extending around the interior of the jar, of a carbon element comprising two cup portions having perforated walls, a flange on the upper portion of the carbon element, adapted to rest on the flanges in the jar, and two ears on the carbon element to which line-wires may be connected.

554,125. Telephone System. Wallace A. Houts, Parker, S. D. Application filed December 24, 1894.

A call-box is provided with a revoluble indicator, a revoluble wheel, a spring having its ends secured to the wheel and the indicator respectively, and arranged to be wound up by the rotation of the indicator relatively to the wheel, and circuit-breaking mechanism operated by the wheel.

554,138. Mechanical and Electrical Development and Storage of Wind Power. Walter L. Negbaur, Brookline, and Joseph J. Feely, Walpole, Mass. Application filed October 9, 1895.

The device for the utilization of wind power is described as consisting of a wind motor and a driving shaft operated thereby, a driven shaft provided with a device for storing energy and an intermissive clutch connection between the two shafts.

554,141. Telephony. Charles A. Randall, London, England. Application filed December 31, 1894.

A telephone transmitter characterized by a single diaphragm in electric contact through the medium of interposed carbon granules, or similar material, with and actuating two or more electrodes insulated from and independent of each other, arranged to conduct the current from two or more independent batteries to the diaphragm in electric contact therewith and the return circuit to the batteries.

554,221. Electric Snap-switch. Gerald W. Hart, Hartford, Conn. Application filed September 27, 1894.

A rotary shaft is mounted on a base piece, the base with a series of stops arranged about the shaft, a spring secured to the shaft so as to turn therewith and with a resilient coil eccentric to the axis of the shaft and with an end adapted to engage the stops, a switch plate loosely mounted on the shaft and loosely connected to the arm of the spring.

Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, FEBRUARY 22, 1896. No. 8

## Röntgen Experiments in Chicago.

During the week considerable progress has been made in the experimental work at the Western Electric company's laboratory in Chicago, and in one case the X-rays were utilized in performing a surgical operation. On Thursday, February 13th, what is supposed to have been the first surgical operation performed in the United States as a direct result of the revelations of Röntgen's rays was effected in ward C of Mercy Hospital, Chicago. The operation in itself was simple and consisted merely in removing a buckshot encysted between the bones of the third and fourth fingers and about 1¾ inches back from the knuckles. The operation was performed by Dr. James Burry, assisted by Dr. J. S. Rankin and Dr. J. L. Miller. The subject was Louis Burkhart, who lives at 725 West Madison street, Chicago. Burkhart had presented himself at the Western Electric company's laboratory on Tuesday, February 11th, complaining of a sore hand, and importuning Charles E. Scribner and Dr. Burry, whose experiments with the cathode rays had come to his notice, to shadowgraph his hand preparatory to a surgical operation for the removal of what he believed to be a foreign substance of some kind, possibly a bullet which he had received 2½ years ago near Strasburg, Germany. Mr. Scribner and Dr. Burry consented to try the experiment, and after an hour's exposure to the cathode rays secured a plate of the injured member from which they developed a negative revealing clearly every bone in the hand and showing what appeared to be a buckshot in the spot referred to. The operation was simple, and no trouble whatever was experienced, as the exact location of the bullet had been shown by the plate in possession of the surgeon.

RÖNTGEN EXPERIMENTS IN CHICAGO.

One of the most satisfactory results thus far obtained was the print from which the picture on this page was reproduced. The subject was one of Mr. Scribner's assistants; the exposure lasted 1½ hours, and eight volts instead of six were employed. Mr. Scribner was particularly pleased with this result, as the negative clearly indicated every bone in the member; in fact, so clear was the result that the inside of the bones of the hand were shown. Another result of this experiment was that it demonstrated the fact that the new photography, or sciagraphy, as Professor Stine terms it, will be of incalculable value in the study of anatomy. In mounting subjects—the hand, for instance—much has been lost, and it has been impossible to secure such satisfactory results as that which the present experiments develop. A careful study of the picture here presented will show many important differences and minor details between this reproduction of the live subject and a mounted skeleton. For this reason alone the work of Mr. Scribner and his associates in perfecting the process will prove of great value to future experimenters.

Dr. Burry delivered a lecture on Monday evening before the Chicago Medical society, in which he discussed the application of Röntgen's discovery to surgery, and illustrated his ideas with prints from negatives taken by this process. Speaking of the advancement already made, he said: "Upon a fluorescent screen of this powder it is possible to project an instantaneous shadow which would reveal to the surgeon all that a good shadowgraph would show, and it is in some such way as this, it seems to me, this process will be used by surgeons. If I am correct in this, two minutes' time would give the surgeon a clear idea of the condition of the parts he wishes to investigate."

## The New Photography.

By W. M. Stine.

The present excitement over the announcement of a new species of photography recalls the historic discovery made by Oersted in 1819. For years scientists had been guessing and dreaming about a possible connection between electricity and magnetism. After having studied and experimented in vain for 17 years, the happy combination occurred to this investigator, and he deflected the magnetic needle by means of a current. This discovery produced a perfect furore in Europe. We may well pause to ask why. From it has come the theories of electro-magnetism and practically all modern electrical appliances. It may not be out of place to compare the present discovery with this famous historical one. The interest of the masses has been aroused by the gruesome shadows of the bones taken through the flesh, and the mysterious outlines of coins through boards, and the like. However interesting this may be, we know it will soon pass into the commonplace. But there are other and vastly more important reasons for the way in which the matter has taken hold of the scientific world—reasons which seem to indicate that the results to be finally obtained will be far-reaching and clear up many misty and disputed theoretical problems, and may even lead to the direct production of light. It is scarcely probable that the new sciagraphy, if such it may termed by analogy to photography, will afford any general and practical application; yet its consequences must be of influence on science having to do with disturbances in or of the ether.

Both the general and technical press are giving it the widest attention, and some of the knottiest problems in physics are so often referred to that a systematic summary of results so far obtained, and the recent scientific issues at stake, will certainly prove of value to the general reader.

Some four years ago Hertz found that metallic films were partially transparent to the radiant streams from the negative terminals of a Crookes tube. The untimely death of this brilliant investigator left the matter in the hands of his assistant, P. Lenard, to more fully develop. In 1894 he published some results which now are of greatest value in understanding the "new" radiation. The work of Professor Röntgen seems to be merely in extension and application of what had been so recently developed.

As a matter of course, there are many and widely various explanations advanced. Many of them are so fanciful that they merit no attention. However, the views entitled to serious consideration explain the results as caused by: (*a*) Infra-red rays; (*b*) ultra-violet rays; (*c*) transmitted cathode rays; (*d*) longitudinal vibrations. The last suggestion has been made by Röntgen himself, and is causing a warm discussion among leading physicists. Should these rays be shown to be longitudinal ether vibrations, the new discovery will prove one of the most valuable ever made. Present interest centers on its bearing on the two rival theories of light, and as such frequent reference is being made to these, they may be briefly stated.

The electro-magnetic theory of light was advanced by Maxwell, and, as it is largely a matter of mathematical deduction, is difficult to picture. When an electrical charge on a plate or a current in a conductor is changing in amount, this sets up in the ether an electrical displacement which will vary with the exciting cause, changing from positive to negative with such changes in charge or current. Such disturbances pass out into free space with the velocity of light and are supposed to be identical with light waves. The ordinary sine curve of the alternating current is but the picture of the action of such stresses. This theory regards the ether as a solid capable of the transverse stresses, but perfectly incompressible, so that only such transverse vibrations are possible. Now, if it can be established that longitudinal vibrations do occur in the ether, the present electro-magnetic theory of light must be seriously modified. The rival theory of light is a purely mechanical one. It regards the ether as an elastic solid, like gelatine, in which a rapidly vibrating body sets up lateral displacements, which are propagated like waves on a stretched rubber tube. Only bodies of molecular dimensions are capable of disturbing the ether. For example, a simple molecule acts much as a vibrating tuning fork. As its free edge vibrates to and fro, it sets up lateral displacements which give rise to transverse vibrations; the sides of the molecule, also producing compression, set up longitudinal waves. A tuning fork would set up both longitudinal and transverse vibrations if it moved in a mass of highly elastic gelatine. Such high authorities as Lord Kelvin and Dr. Boltzmann admit the possibility of longitudinal vibrations in the ether. Any new experimental evidence on longitudinal ether vibrations must influence our view of gravity. Some have attempted to explain gravity by means of longitudinal ether

stresses. Inferest now centers on whether the ether takes up longitudinal waves of rarefaction and compression or only stresses. Any experiments which shall demonstrate the existence of true longitudinal waves will add immensely to our knowledge of the properties of the ether. If the ether is a perfectly rigid solid, then only longitudinal stresses can exist, and these are transmitted with an infinite velocity. This condition is necessary in order to explain gravity by means of stresses. On the other hand, should the presence of longitudinal waves be demonstrated, it will show that the ether is not perfectly rigid, but is subject to compression. This will mean that the velocity of such waves is not infinite but may be calculated. It must be confessed that these new experiments strongly indicate the presence of true longitudinal waves. If this is confirmed, we may confidently expect much new knowledge on all ether phenomena, especially those of a chemical nature.

What is the cathode ray? It is an effect produced at the negative or cathode plate of a Crookes' tube. When pulsating high potentials are applied to the plates of such a tube, a stream of luminescent particles seems to fill the entire tube, whose walls fluoresce with a green light, if they are made of German glass, or with a bluish tinge if made of lead glass. These rays proceed only from the negative electrode, and their nature has been in great dispute. Some recent experiments by M. Jean

PROF. WILHELM KONRAD RÖNTGEN.

Perrin' seem to settle all doubts as to their character. By means of specially constructed tubes he found the cathode rays able to impart a negative charge to a conductor. He concludes that the cathode rays are streams of particles of the gas still in the tube, thrown off by repulsion from the negative plate after they have become negatively charged. He also proves the existence of streams of particles from the anode charged with positive electricity. The negatively charged molecular streams are luminescent in consequence of vibrations set up by impact with the charged cathode. These particles usually move in straight lines, and, impinging on the walls of the tube, impart their energy to the molecules of the glass, which in turn become fluorescent. It is to be noted that these cathode rays are deflected by a magnet. It is in keeping with what is a well-known fact that rapidly moving charged bodies are deflected by a magnet.

Prof. Röntgen considers that the newly discovered sciagraphy is due to longitudinal vibrations of what he terms "X," or unknown, rays. A summary of the facts so far at our command shows that the rays (*a*) are not refracted by a lens or prism; (*b*) they produce fluorescence; (*c*) that all known matter are more or less transparent to them; (*d*) they are not deflected by a magnet, (*e*) are not absorbed by a solution of alum, but by a solution of [illegible] are capable of producing chemical changes. In view of these facts, let the four explanations above given be noted.

[illegible]

That the "X"-rays are not infra-red or long transverse rays seems proven by the transparency of alum solutions, for it is a well-known fact that all infra-red rays are absorbed by an aqueous solution of alum. The suggestion that the "X" rays may be ultra-violet is a more formidable one to meet. These rays are often called actinic, and are supposed to be especially active in ordinary photography. However, like ordinary light rays, the ultra-violet waves are refracted and focused by lenses. Though a plausible explanation, facts seem against it. But it is to be expected that the ultra-violet guess will be most vigorously defended by conservative and mathematical theorists. The fact that a magnet is without influence on the "X" rays differentiates them at once from cathode rays, and it is by no means proven that true cathode rays may pass through dense substances of considerable thickness. Besides, sciegraphy has proven possible in the apparent absence of all cathode rays.

We now come to the explanation offered by Professor Röntgen himself, that the radiations at issue are true longitudinal ether waves. It must he admitted that so far such an explanation best explains all the known facts, though it would be extremely rash to affirm as yet that it is the only possible theory in the premises. This presupposes that the ether is at least slightly compressible. Such vibrations could transmit the energy from the electrified source to the chemical molecule and throw it into vibration with the consequent image on the plate. Such waves would probably have very long wave length, and hence be so slightly refracted by a lens or prism as to possibly escape all experimental determinations. Further, in consequence of long wave length, they could readily pass through solid bodies. It is a matter of common experience that extremely low tones or notes pass through walls more readily than vibrations in a higher key. Such rays would not be deflected by a magnet, and being able to produce chemical changes, could also transmit the energy to set up fluorescence.

Professor Oliver Lodge has put forth one other suggestion; that the results follow from a species of electrolysis. This is really the only dangerous rival to the theory advanced by Professor Röntgen. Several experimenters have made excellent shadow pictures, using two plates connected to an induction coil. Here one can scarcely conceive of any but an electrolytic explanation. The writer inclines to a modified view, which, in a sense, unites the longitudinal wave and electrolysis theories. Longitudinal waves seem to offer a more satisfactory explanation for electrolytic phenomena than any so far advanced. No doubt we are on the eve of some new theoretical developments which may broadly modify physical science.

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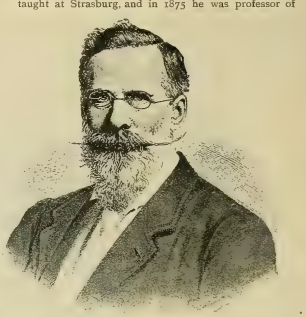
The electric light committee of the City Council of New Castle, Colo., has decided to advertise for bids for an electric light plant for the town.

## Prof. Wilhelm Konrad Röntgen.

Very few men have so suddenly attained fame as the subject of this sketch. Before the announcement of his remarkable discovery regarding the new form of radiation, made known in his communication to the Würzburg society, which was reprinted in the WESTERN ELECTRICIAN last week, he had gained some prominence on account of his experimental work and his writings upon scientific subjects, but to the world at large he was comparatively unknown. His published works show him to be a man of splendid attainments, though, and his last communication, in which he gave to the world the result of his experiments with a new form of radiation, insures for him lasting fame. Since his last discovery was announced there has been much interest in the man himself and his former work, as well as in his late achievement. At the present time he is a professor in the Würzburg University, with which institution he has been identified since 1888, when he left the institute at Giessen. He was educated in Switzerland and lived in that country several years, but he is Dutch by birth, and first saw the light in 1845. While in Switzerland he prepared a monograph on the way to establish the relations of the warmth that exists in the atmosphere. This attracted considerable attention to the author, who at that time had not yet finished his course of studies at Zurich. He acted as assistant to Professor Kundt at that time, and when the latter retired from Zurich, Röntgen accompanied him to Würzburg and later again to Strasburg University, where Kundt held the position of professor and Röntgen was again his assistant and favorite pupil. In 1873 Röntgen taught at Strasburg, and in 1875 he was professor of



WILLIAM CROOKES, F. R. S.

mathematics and physics in Wurtemburg, but in 1876 he returned to Strasburg University, and in 1879 was appointed professor and director of the University Institute for Physics at Giessen. He went to Würzburg University again in 1888 and has remained there ever since.

During all these years Professor Röntgen has been a very industrious student and experimenter, and his contributions to scientific literature have been frequent. His career has verified the excellent opinion with which the scientific world received his first publications. Among his contributions to literature was a treatise on a method to fix the isothermal surfaces of crystals: and a later volume was on a method to determine the intensity of sunlight. Electricity had occupied much of his attention while he was still in Zurich, and he studied the figures produced in dust by electrical discharges as Professor Kundt showed them, and the curious phenomena shown by electricity passing through various gases. Another favorite topic was the absorption of ordinary heat rays by steam and gases. In acoustics he studied the sounds emitted when gases are intermittently lighted up, and he published a valuable treatise on the theory and operation of the telephone. He invented an aneroid barometer to tell the weight of the atmosphere.

It will be understood from this brief sketch that the eminent Hollander has been a very busy man, and that he has accomplished much in a comparatively short space of time.

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The Treasury Department at Washington, through the office of the supervising architect, has awarded the contract for one electric passenger elevator for the postoffice building at Scranton, Pa., to the Sulzer-Vogt Machine company of Louisville, Ky. The amount of the successful bid was $2,540, and the time for completion 70 days

## William Crookes, F. R. S.[1]

The recent remarkable discoveries of Prof. Röntgen when engaged in experimental work with a Crookes tube have brought prominently before the world the name of William Crookes - a name that was already famous in the world of science. There are, indeed, few, if any, among the scientific leaders of the latter half of the nineteenth century who have had a more brilliant and varied career than the author of the vacuum tubes which have made possible the recent startling developments in photography.

He was born in London in 1832, and at an early age turned his attention to photography. After a course at the Royal College of Chemistry under Dr. Hoffman, during which, at the age of 17, he gained the Ashburton scholarship, he became in due time senior assistant to his tutor. This post was rapid, and at the age of 22 he was appointed superintendent of the meteorological department of the Radcliffe Observatory at Oxford. In 1859 he founded the *Chemical News*, and five years later he became editor of the *Quarterly Journal of Science*.

Prof. Crookes had a natural love for original research. In 1861, while examining the residues from a sulphuric acid works, he discovered the new metallic element thallium. This was followed by his election as a fellow of the Royal Society. It was his "delicate spectroscopic investigations" in connection with the newly discovered element "which led him to the study of the 'rare earths,' which proved so fruitful in his hands."

The mining world is also indebted to him for drawing attention to the value of sodium amalgam in the extraction of gold. At a later date he called in the aid of the alternating electric current. This agent, acting in concert with various mercurial salts, and particularly with mercury cyanide, has rendered possible the extraction of gold from highly refractory ores.

In 1872 he was at work on his investigations on "Repulsion Resulting from Radiation," to which question his attention had been drawn by his observing the action of heavy pieces of glass which he was weighing in a vacuum balance, which, by the way, was his own invention. In 1877 he invented the otheoscope, and in the same year science signified its indebtedness to him by electing him a member of the Royal Society. In a paper before the society he stated that he had "succeeded in obtaining a vacuum so nearly approaching perfection that the pressure in it was only 0.4 millionth of an atmosphere." These experiments led to very important results, for it was found that in such an extreme vacuum gases pass into an ultra-gaseous state, which Prof. Crookes termed a state of "radiant matter;" and further, these extreme vacua opened up the way for the incandescent lamp.

A March number of the *Electrician* of 1891 says: "Professor Crookes' house in Kensington Park Gardens, electrically lighted in 1881, was, we believe, the first house in London fitted up with the electric light. It may be interesting to state that the wires were chiefly laid with his own hands. To meet the difficulty of obtaining carbon filaments for the glow lamps, not possessing the structure of the material from which they were made, Prof. Crookes dissolved cellulose in a nitrong solution of ammonium copper sulphate, dried up the solution into sheets, dissolved out the copper, and used the horn-like material remaining for filaments. The lamps in the inventor's house, fitted with such filaments, remain still in good working condition."

In 1880 the French Academy of Sciences conferred upon Prof. Crookes an extraordinary prize of 3,000 francs and a gold medal, in appreciation of his researches in molecular physics and on radiant matter.

His studies of the "rare earths" have led Prof. Crookes to the conclusion that "the bodies which have generally been accepted as elements are not primordially distinct or independent, but have been formed by a process of evolution remotely analogous to that which we now recognize as having been at work in the formation of organic species." These views were put forth in his presidential address before the chemical section of the British association, under the title "The Genesis of Elements;" and it is undoubtedly his most splendid among many brilliant contributions to the philosophy of science. In 1885 the Society of Arts, and in 1888 the Royal Society, gave him medals, the first "for his improvement in apparatus for the production of high vacua and for his invention of the radiometer," and the latter society "for his investigations on the behavior of substances under the influence of the electric discharge in a high vacuum."

In addition to his extensive work in the laboratory, Prof. Crookes has been a voluminous contributor to the scientific literature of the age. Among other works he has written "A Hand-book of Dyeing and Calico Printing," "Select Methods in Chemical Analysis," a manual of "Dyeing and Tissue Printing," a work on "The Solution of the Sewage Question." He has translated and edited Reimann's "Aniline and its Derivatives," Wagner's great work on "Chemical Technology," and many other works of scientific prominence have emanated from his busy pen.

The splendid results which have attended Prof. Crookes' labors are not to be attributed solely to his undoubted genius for experiment and observation. They are largely the result of persistent hard work carried out on logical lines and with strict attention to method. He possesses that "infinite capacity for taking pains" which is indispensable to genius, if its powers are to produce valuable, lasting results.

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The West End road of Boston has now 272 miles of track, and is capitalized at something over $90,000 a mile.

1. From the *Scientific American*.

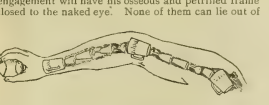
## Another Application of Röntgen's Discovery.[1]

By O. P. Taylor.

The time has come to settle the question whether there is glass in "Buck" Ewing's right arm. Professor Röntgen's recent discovery, whereby the bones in a man's body can be photographed without removing the flesh, will serve to disclose the alleged crystallized muscles of "Buck's" once great arm.

This newest system of photography is as valuable to the science of baseball as smokeless powder is beneficial to stage battles and home suicides.

Every manager will, possibly by next year, be armed with a transformer, a Crookes tube, a Leyden jar and some cathode rays, whereby every suspect applying for an engagement will have his osseous and petrified frame disclosed to the naked eye. None of them can lie out of



ANOTHER APPLICATION OF RÖNTGEN'S DISCOVERY.—BASE-BALL PLAYER'S GLASS ARM.

it then, and draw $500 in advance upon the statement that his arm was never so strong and powerful.

A great man is Professor Röntgen! Perhaps his camera can penetrate the skull of Patrick O'Mally Tebean and give us a picture of the wonderful machine in motion.

In the cause of science I have made a little experiment of my own. Armed with a cathode ray, and following the lines of photography recently laid down by Professor Röntgen, I have succeeded in getting a picture of the bones in the glass arm of a celebrated ex-pitcher of the National League.

As will be plainly seen, the cause of this man's decadence of power and usefulness to the baseball profession is clearly defined to the naked eye.

How the glass got there must be surmised.

What a wonderful thing is the advance of science!

## X-ray Stories from Various Sources.

The European and American press contains new tidings of the Röntgen photograph discovery from many sources. For instance, at a recent meeting of the Paris Academy a science lecturer showed two photographs of a woman who was suffering from atrophy caused by tuberculosis. Her condition was fully revealed, as also was the case in the photograph of the bones of the same woman's knee showing inflammation of joints.

The Spanish papers announce that Spanish scientists are conducting experiments along original lines. The Barcelona *Universal* declares it is an important fact that no one has yet been able to photograph the heart, but this is scarcely likely to remain unperformed.

From Germany comes news that Röntgen is about to publish a pamphlet for which all the scientists in the world are on the qui vive.

From all over Europe photographs of hands and feet, the discovery of bits of copper wire, needles and the like are taken almost daily. A needle was seen in a woman's hand in Birmingham last week. In London an effort is being made to form a society for making serious experiments in the new photography.

Harold Frederic, the London correspondent, relates this story. Although it is evident that America is fully abreast of Europe in expanding and developing Röntgen's discovery, some quaint incidents of the process here may not be duplicated on the other side. For instance, the Vienna Museum for some time has possessed as its chief treasure an Egyptian mummy, which is swathed to resemble a human being but with an inscription which suggested it to be an ibis instead. The thing was too rare and precious to run the risk of unwinding its bandages to solve this paradox, but the shadow photograph now plainly reveals the skeleton of a large bird.

A Toronto dispatch, dated February 14th, says: Today in Grace Hospital the value to surgery of Prof. Röntgen's discovery was again demonstrated. A woman patient, whose foot had caused her intense pain, was submitted to the cathode rays, and the photograph revealed the presence of a needle. Prof. Wright of University College, who conducted the experiment, pointed out to the surgeons the exact location of the foreign body, and an operation at this point proved the photograph to be a true one.

☐ From Buffalo comes a statement that a local physician, Dr. Elmer G. Starr, has succeeded in producing the X-rays by an interrupted electric discharge of high potential, without a vacuum, thus dispensing with the Crookes tube. A photographic negative, or rather a positive, was made with this radiation, it is stated. The print will make the dark parts appear light, and the light dark.

## Edison on Prof. Röntgen's Discovery.

Two interviews have been published by New York papers in which Edison, who is reported as being hard at work upon experiments with the X-rays, expresses the belief that the great European scientist will not profit financially by his discovery. The *World* contributes the sketch herewith reproduced to the "popular" consideration of the subject.

"What I want to learn about this thing," Edison said to the *Sun* reporter, "is to what practical advantage I can apply it. That is my business. Prof. Röntgen has opened to the scientific world a new field, and his discovery is undoubtedly a great one, but I do not believe that it will yield him any financial returns. It has been said

THE EDISON DAILY MATINEE AND X RAY PERFORMANCE.
[From the New York *World*

that his discovery was a mere accident, but I do not believe that. I give him credit for accomplishing what he has by good hard study and solid experiments."

"Professor Röntgen," he is reported in the *Herald* as saying, "will probably never realize a dollar from his discovery. He is one of that class of pure scientists who study nature's mysteries for the love of knowledge and experiment, and, after they have produced something wonderful, some fellow like me, who views such things from a commercial standpoint, comes along and turns it to practical account. That is the condition of Dr. Röntgen's discovery. It is a wonderful one, but we have now got to find out what it can be utilized for and give it a place and value in the commercial world."

1. From the *New York Herald*.

## European Practice in Overhead Trolley Construction.

In view of the recent litigation over street railway patents and Judge Townsend's decisions in the Van Depoele patent cases, by which the General Electric company was given a practical monopoly of what may be termed the distinctive patent feature recognized in the ruling of the United States Circuit Court on this patent, that in order to be operative the American device must provide for lateral motion, as otherwise the trolley wheel could not remain on the trolley wire, which, while theoretically above the center line of the track, really deviates considerably in practice. In the European device no lateral motion is provided for, and as a matter of fact the trolley wire in this construction is preferably not above the center line of the track. Again, the European device makes the overhead construction much simpler and cheaper, it is claimed, reducing for instance the number of suspension wires at curves and doing away entirely with overhead switches and frogs, so that the decision of the Court of Appeals sustaining Judge Coxe's findings regarding the Van Depoele switch patent would not apply to this construction. This overhead construction, it may be remarked, is preferable to American practice from an aesthetic viewpoint, while on the other hand the appearance of the contact device on the top of the car as shown in the cuts, might for the same reason be objected to.

FIG. 1. EUROPEAN PRACTICE IN OVERHEAD TROLLEY CONSTRUCTION.

the American type of overhead under-running trolley, it will be of interest to street railway managers whose roads are not equipped with General Electric apparatus to find a practical method of operating trolley lines without infringing the Van Depoele patents. At the present time an appeal from Judge Townsend's decision is pending, but street railway men do not seem to be inclined to await the result of this proceeding. It is of special interest at this time to consider the methods employed abroad, for while American engineers claim to be far in advance of their European contemporaries in the matter of electric railway development, it is generally admitted that there are many desirable features in the form of construction employed in Europe that might with advantage be introduced here, and in the present case American engineers will gladly avail themselves of any plan that will insure protection from patent litigation and make a monopoly in this field impossible. It will be seen by reference to the picture on this page that there is a radical difference in the appearance of the trolley device employed in the system here illustrated from that generally found in American cities. The cut, Fig. 1, shows a car on the overhead trolley road at Budapest, equipped by Siemens & Halske of Berlin, and this may be accepted as an excellent type of European practice. There are several forms of this device in use in Europe and further modifications may be made, if considered necessary, to conform to American ideas. In Fig. 2, for instance, the appearance of the device is somewhat changed, but the principle is the same. This is also true of the form shown more in detail in Figs. 3 and 4. The longitudinal elevation and plan of mounting are illustrated in Fig. 3 and the transverse elevation is shown in Fig. 4. This apparatus, which, by the way, is really a sliding contact collector, consists of a metal frame, pivoted and spring-supported on the deck of the car, the upper part of the frame carrying a horizontal contact bar made of special metal and extending transversely four or five feet. This bar slides with constant pressure on the line wire.

It may be contended that the European device constitutes an under-running trolley as defined in the valid Van Depoele patent. Attention is directed, however, to the fact that contact may be made in this way when the trolley wire is above the center of the track, and at other times when the wire may slip off the trolley, as, for instance, in rounding curves, contact is made with the bar.

It is believed that this system can be applied to American cities, inasmuch as the requirements of European municipalities are much more exacting, and yet it

Aside from the appearance of this apparatus, there are many material points of difference in construction and operation that will readily appear upon closer examination. As compared with the ordinary trolley, or rolling contact collector, the Siemens apparatus offers the great advantage of insuring permanent communication with the supply line under all conditions. It entirely does away with the frequent interruptions of contact due to the jumping of the trolley, especially on curves or passing under frogs and wire hangers, when the speed is not kept within a low limit. Objection has been raised to the use of the sliding contact on account of the considerable friction and the consequent noise and wear of the working parts. Siemens & Halske claim, however, that the noise with the sliding collector is not greater than that experienced with the trolley, and, as regards the wear, by constituting the contact bar of a special soft alloy the line wire is not only protected from any deterioration, but its lower surface becomes gradually covered with a layer of particles from the softer metal, the contact thus becoming improved. All the wear is taken by the contact bar, which is interchangeable, and may be easily replaced. In order not to concentrate the wear on a single point of the bar, the line wire may be stretched with slight deviations from the axis of the track, making a kind of zigzag line. A recent improvement introduced into this system consists in the substitution of a soft alloy contact bar with an aluminum channel, of U-shape and filled with grease, so as to insure a certain lubrication of the contact. It is stated that by this contrivance all noise is practically avoided, and less power is lost in friction, besides which the renewal of the slider bar need not be so frequent. This latter improvement is of considerable importance, as will be readily recognized by engineers, as it will permit of much higher speeds, without danger of losing contact, than is now possible with devices employing a trolley wheel, especially where there are numerous curves in the road. The Siemens & Halske Electric company of America, which controls the patents in this country, has been engaged in an extensive series of experiments at its factory in Chicago with a view of testing the latest improvements that have been suggested by experience in European practice.

One of the latest contact devices of this character which the Siemens & Halske Electric company of America developed consists of a sort of compromise between the European and American trolleys and illustrates the adaptability of this idea to special requirements. In the device shown in Fig. 5, it will be noticed that a trolley wheel or roller is inserted in the center bar

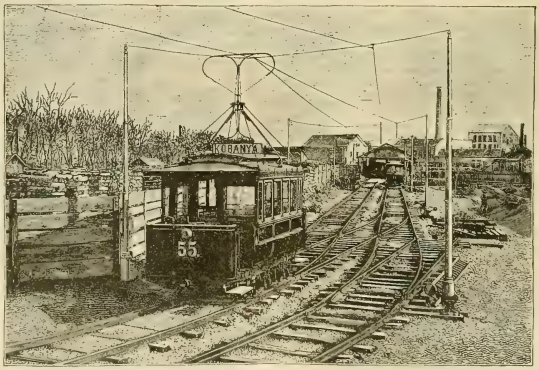



FIG. 2. EUROPEAN PRACTICE IN OVERHEAD TROLLEY CONSTRUCTION.

is in successful operation at Hanover, Dresden, Bucharest, Lemberg, Bochuma, Barmen, Basle, Vienna, Pankow, Berlin, Budapest and other cities.

## Exclusive Ownership of Street Railway Tracks in Public Highways Upheld.

The Appellate Court of Cook county has affirmed the decision of the Circuit Court to the effect that a street railway company has exclusive ownership of its tracks in public streets. The decision was given in a suit growing out of the "car-smashing" episode of last April, when the Chicago General Railway company attempted to run a car on the tracks of the Chicago City Railway company in Twenty-second street, with the result that the car was completely demolished by the superintendent and men of the latter company. The Circuit Court dismissed the bill filed by the General company to prevent the City company from interfering with the passage of the complainant's cars upon a portion of Twenty-second street. Now the Appellate Court affirms the decision of the lower court, which was rendered by Judge Tuley.

Judge Waterman, in his opinion, says: "It is the duty of the Chicago City Railway company to use for the benefit of the public, as the public convenience demands, all the rights granted to it to lay tracks in the public streets; and to afford the public all reasonable and proper facilities in the way of travel over each and every part of its tracks. To do otherwise, to stand in this regard as a hindrance to the accommodation of the public, is a gross per-

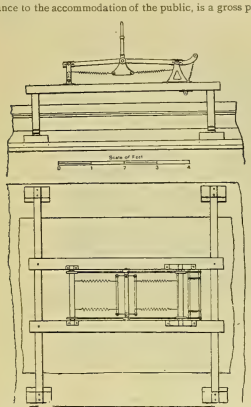


FIG. 3. EUROPEAN PRACTICE IN OVERHEAD TROLLEY CONSTRUCTION.

version of the privileges accorded by the municipal authorities to the City Railway company."

As to the "riot" feature of the case Judge Waterman continues: "But it does not follow that if the City Railway company has done this, or if it has taken the law in its own hands, and with a great force of men by unseemly violence and riot in the public streets, to the annoyance and terror of peaceable citizens, broken and destroyed the property of the Chicago General company, that thereby the latter has acquired the right to make use of the rails of the City Railway company in any portion of Twenty-second street."

As to the rights of the Chicago City Railway company the court adds: "The right, in consideration of services rendered the public, to lay tracks in the public street and to operate cars thereon is a valuable property, and is therefore a right. How lasting it may be, how it may be regulated or revoked, or taken away, is another matter. Being property held under certain conditions, it may be forfeited, but it can not either in whole or in part be, by the mere will of a legislative body, taken from its owners either for public or private use. If it is to be taken for public use, its owners are entitled to just compensation, and that compensation, it would seem, must be ascertained by a jury. The decree of the Circuit Court dismissing the bill is therefore affirmed."

Work has been begun on the stack of the plant of the Potomac Electric Light & Power company in Washington, D. C. When completed this will be the tallest chimney in the District. It will be of steel and will tower 200 feet above the roof of the building.

## Remarkable Atmospheric Phenomenon.

An Omaha correspondent writes that Superintendent Korty, of the Union Pacific's telegraph department, in speaking of the salt storm which occurred in Utah and Wyoming on New Year's Day and interfered with the working of the telegraph wires, makes this statement:

On the afternoon of January 1st a very peculiar rainstorm occurred in eastern Utah and western Wyoming along the Union Pacific railway, extending from Ogden, Utah, to Evanston, Wyo., a distance of 75 miles. The rain consisted of salt water or brine. The clothing of persons exposed to the shower had, when dry, the appearance of having been sprinkled with whitewash. The windows in the stores and residences at Evanston were so encrusted with a salt deposit as to make it impossible to look out. Dr C T Gamble of Almy, Wyo., a gentleman of undoubted reliability, states that the storm deposited in Almy alone 27 tons of salt. "This assertion may appear fabulous," says the doctor, "but nevertheless is true, as it has been proven by carefully estimating the quantity on a given subject in different parts of the camp. The area of Almy is something over nine miles, and three tons to the mile would make 27 tons of the matter deposited. The salt if collected and sacked would make 10 ordinary wagon loads. Those who doubt the above statement can go to figuring."

The salt storm lasted about two hours. After it had ceased raining the sun came out, and as fast as things dried they turned a whitish color, and it was found that everything was covered with a thick coating of salt. Cars, buildings, trees, telegraph poles, insulators and wires all looked ghostly in their white coats. Through Weber canyon the salt storm turned into snow later. A peculiar effect of the salt deposit on the telegraph poles, arms and insulators through Weber canyon was noticed in operating the wires. During the day, when the sun came out, the wires worked clear and without interruption, while at night, when it turned cold, the wires were rendered unserviceable, which was attributed to the fact that the snow, having melted some during the daytime and again freezing at night, created a moisture in conjunction with the salt deposit underneath, so as to entirely destroy the insulation of the wires. After several unsuccessful attempts to remove the cause of the trouble, an engine with a pump and long hose was sent over the lines and the deposits thoroughly washed off the poles and fixtures for a distance of 40 miles. The wires of the Rio Grande Western railroad between Ogden and Salt Lake City were slightly affected the same way, as were also those of the Southern Pacific for a short distance west of Ogden.

The only theory that is given for this phenomenal storm is that the salt was raised in vapor over Salt Lake and was carried by the wind and deposited over the country for many miles to the eastward.

## Electric Circuit of St. Louis.

At the annual meeting of the Electric Circuit of St. Louis, W. S. Meckle was elected president, Tyler Sturgeon vice-president, George Bahret secretary, T. S. Clark treasurer and G. S. Montgomery sergeant-at-arms. The entertainment committee for the ensuing year is composed of A. R. Pike and Gus Sachs. Fifty persons took part in the banquet succeeding the election. The toasts responded to were: "Natural Gas," G. E. Montgomery; "Electricity in the Future," Gus Sachs; "The Electric Circuit," George Bahret; "The Year's Advance in the Lighting and Power Industries," Alex. R. Pike. Prof. G. W. Krall, of the Manual Training School of Washington University, was the guest of the evening. The professor has been indirectly connected with the Electric Circuit since its inception, and has done much toward assisting it in attaining its present success. The organization has doubled its membership many times during the short period of its existence. The club now has handsome permanent quarters at 1600 Locust street, and numbers among its members a majority of the practical electricians in all branches of the craft in St. Louis.

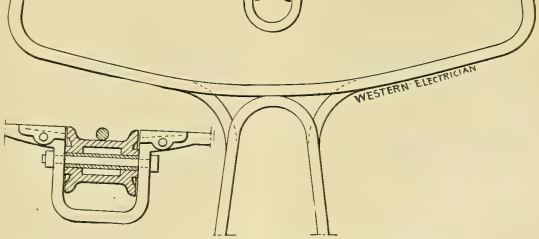



FIG. 5. EUROPEAN PRACTICE IN OVERHEAD TROLLEY CONSTRUCTION.

## Unique Feat in Telegraphy.

The work recently done by the New York *World* in querying every bank of consequence in the United States as to its readiness and ability to subscribe to the new government bond issue was an object lesson in the perfection to which the telegraph service has been brought. The facts and the figures are astonishing.

In carrying out the idea one or more messages were sent to every city, town and village in the United States that has a banking institution. To reach them all it became

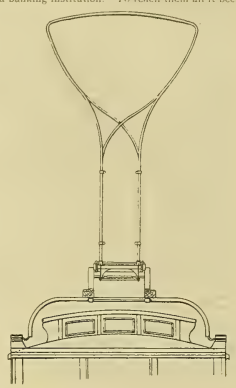


FIG. 4. EUROPEAN PRACTICE IN OVERHEAD TROLLEY CONSTRUCTION.

necessary to send 10,370 separate telegrams, and including replies, the grand total of messages was about 17,500.

The messages were sent out in two lots. It was decided to first sound the national banks. To reach them all it was necessary to send 3,698 telegraphic inquiries. This was done on Sunday night, January 5th. The Western Union Telegraph company had been notified that it would receive this great volume of extra business, and Night Manager E. F. Cummings, at the main office, detailed Frank B. Smith to personally attend to trafficking the business. At six o'clock in the evening the messages were delivered to the Western Union people. By midnight the last had been sent.

The task of reaching the state and savings banks, trust companies and private bankers, which was undertaken five nights later, was twice greater than that of reaching all the national banks, for it was necessary to send out nearly twice as many messages—6,672.

The work was commenced at six o'clock in the evening and by 2 A. M. every message had been handled. Every message reached the bank as soon as it was open for business. The great bulk of the answers came the morning after the messages were sent.

It was a great undertaking. Never before had the Western Union Telegraph company been called upon to handle such a great number of messages at one time by any one person or corporation.

M. W. Rayens, the manager of the delivery department at 195 Broadway, handled the immense number of replies in such a manner as to call forth praise from the *World* for the prompt service.

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HIGH WATER MARK

CIRCULATION, 16,630.


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One of the most interesting contributions upon Professor Röntgen's discovery is presented on another page this week, entitled "The New Photography," and is a concise statement by Professor W. M. Stine of Armour Institute, Chicago, upon the experiments, researches and discoveries in this particular branch. Professor Stine has made this matter a subject of special study, and his views are entitled to consideration. His use of the term "sciagraphy" (from the Greek, skia, a shadow, and graphein, to write) may not be generally adopted, but it is worthy of consideration.

It is gratifying to note the interest that is everywhere shown in the progress of the Röntgen experiments now being conducted at the laboratory of the Western Electric company in this city by Charles E. Scribner and Dr. James Burry. Last week these experiments were described and profusely illustrated in the Western Electrician, and since then the work has been continued and much progress has been made. It has been demonstrated that the [illegible] of Professor Röntgen can be applied to [illegible] it [illegible] clearly shown that it will be a great aid to students of anatomy. Chicagoans reflect with considerable pride upon this excellent record, and it is of course particularly gratifying to those directly interested in electrical science to see the city gain such distinction. It is worthy of note that the facilities which have enabled the zealous experimenters to conduct their investigations, the splendidly equipped laboratory placed at their disposal and the corps of experts to assist in the work, were furnished by a private corporation engaged in commercial pursuits in Chicago. The public spirit and disinterested motives which prompted this undertaking should not be overlooked. It may be remarked that it is this public spirit, so prominent in all Chicago enterprises, that has earned for the city its fame in this and foreign lands.

Barrett is again doing the heavy. This time he is posing before the public in his favorite attitude as an electrical engineer. His apparent longing for recognition in this rôle may be explained by the fact that it is so utterly impossible of attainment that the idea possesses fascination. At any rate, we find him recommending plans for the installation of electric motors to turn Chicago's bridges and the enlarging of the electric lighting installation of the city hall, both very commendable projects to be sure. There is no question about the desirability of turning the bridges by electric motors, nor is there any inclination to deny the necessity for more incandescent lamps in the city offices, but there is one feature about the affair that stands out so prominently that it cannot be overlooked. It is Barrett's attempt to pose as an electrical engineer and get a little applause from the public, which he does not deserve, for his "plans." There are standard rules of practice followed by engineers in such cases, but Barrett probably knows nothing about this or he thinks he can make the people of Chicago believe the idea originated with him. The "professor" is certainly in a bad way when he has to resort to such devices.

Special interest attaches to the article printed on another page this week, in which a type of overhead electric railway construction common in European cities is described. In appearance it does not compare favorably with the American trolley pole and wheel, for which it may be used as a substitute on account of the recent patent litigation affecting the overhead under-running trolley and the overhead construction for trolley lines. The European device is a sliding contact collector, and, while it appears cumbersome and to many may be unsightly, it possesses many excellent features that may influence street railway managers and the public in its favor. It may not be amiss to call attention to the fact that this style of construction has been adopted on the overhead trolley system at Budapest. In the mind of the average American reader there is an impression that the street railways of that town are equipped entirely with the conduit system, whereas the overhead system is extensively employed, and the lines thus equipped run out in all directions from the business center, where the conduit road is used. It may be interesting, too, to mention that conduit lines are prohibited in some parts of the town, as well as the overhead construction, and in one instance a tunnel road two miles in length, extending through Andrassy street from the river directly across the town, was the only plan that would be accepted. This will of course be electrically equipped and will make another interesting feature of transportation in this celebrated town. It will doubtless be a revelation to some of our vociferous American city officials that in Budapest, the city *par excellence* of the underground conduit railway, there is an extensive overhead electric system in operation and that the people are well pleased with the service.

Telephone rates form the subject of proposed legislation at Albany each year, but thus far the Bell interests have succeeded in defeating these measures. At the present time there is a bill in the Senate committee on finance, providing for the regulation of rates and the establishment of a telephone commission to have a general supervision of telephone matters throughout the state. This, in a general way, conforms to the features of bills heretofore considered. In the Brush bill now under consideration, it is provided that the comptroller, attorney-general and the state engineer shall comprise a telephone commission which shall have power to investigate all telephone companies and to subpœna witnesses, etc. It is evidently the desire of the framers of the bill to guard against the possibility of having the commission used for improper purposes, for it is provided in the bill that none of the employes of the commission shall be interested in telephone companies in any manner, and it is made a misdemeanor for any officer of a telephone company to solicit a place for a friend under the commission. The latter is given the discretion, whenever the profits of any telephone company exceeds 10 per cent., to reduce the rates still more or to advance rates when, in its judgment, the telephone company is doing business at a loss. The expenses of the commission shall not exceed $10,000, to be borne by the several telephone companies doing business in New York state. It is upon the question of compensation that the companies will doubtless make their strongest fight. The bill provides that the annual rates for telephones shall be as follows: In cities of 1,000,000 or over, $125; in cities of 500,000 and less than 1,000,000, $85; in cities of 100,000 and less than 500,000, $48. In fixing these rates the population is to be determined by the census of 1890, and when the rate has once been fixed it shall not be changed by reason of increase in population. The rates for public telephones shall be 10 cents for the first five minutes and five cents for each five minutes thereafter. Those renting instruments are not to be charged for talking through public telephones, and each subscriber is to be given a card that will enable him to use all public telephones free of charge.

The first announcement of a discovery or an invention always develops a curious phase of human nature, which seems well-nigh universal. There are two stages of this disease, which may be called primary and secondary, although these may occasionally blend so completely as to present common symptoms. Usually the attack is sudden, and the patient suffers more or less with febrile symptoms, indicated by a disposition to decry and belittle the inventor or discoverer, and also the result which he has accomplished; and after a short interval the symptoms take on a new form, and a claim of priority is made in favor of the patient, or—well, anybody, so that the person who has made the announcement does not get credit for his work. The disease is something akin to kleptomania, differing only in this: that the person who assists in defrauding somebody is not particular who becomes final possessor of the abstracted article. When the telephone was first publicly announced Mr. Bell suddenly became a very well-known lunatic, and was the preëminently laughed-at individual of the country. The telephone was only a scientific toy, at best, well enough as a plaything, but of no commercial value. So said the skeptics. But the telephone grew, and the public suddenly found out that there were no less than half a dozen claimants for the honor of having invented this "useless toy" long before Mr. Bell had made known his discovery, and attempts were made to steal it wholesale and retail, which were only defeated after large sums of money were spent in litigation. Morse's telegraphic inventions caused the same sort of green-eyed and hook-fingered epidemic. When the acetylene discovery was made known a derisive laugh rang out all over the world; denial of the chemical possibility followed; then when it became an indisputable entity, it was suddenly discovered that it was a well-known laboratory fact; but it was useless, because dangerous, expensive, poisonous, explosive, and the Lord only knows what quality that is bad and wicked that was not attributed to it. Recent experiments reported to the French academy show that it is not only safer but less poisonous than ordinary coal gas.

No sooner had Röntgen announced that he had taken a shadow picture by the direct ray process than half the civilized world commenced to gossip about the assumed results that could be of no possible use, except to amuse; second week, Röntgen's assumed discovery seems to have been for the most part anticipated; third week, Lord Beforehand, or Sir Previous, or the Right Honorable Tichford Claimor seem to have in reality anticipated the Röntgen nonsense, of which there is so little of worth at first sight, but which may in the hands of competent investigators become of slight value, etc.

Now to the ordinary reader, who has never graduated in logic, what seems very funny is this: If 30 or 40 people, more or less, could have done this thing 10 or 20 years ago, why didn't they do it? Why were they "lying supinely on their backs, hugging the delusive phantom of hope," that they might reap the fruition of another's labors, instead of doing the work, if they could? There is a moral, if not a legal, responsibility for knowing how to do these things and not doing them, and afterward claiming credit when some other laborer accomplishes the work.

The question at issue is not whether others could have produced the Röntgen effects, but why didn't they?

## Study of the Fuse Problem and Solution.[1]

By William McDevitt

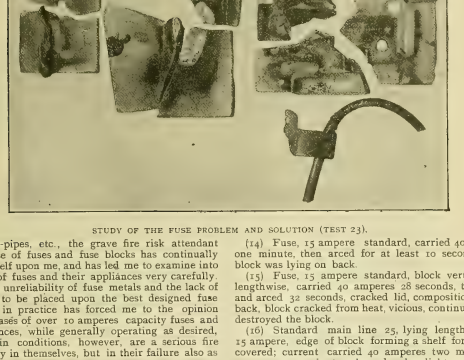
In all the strides for improvement in electrical devices there is none which has received as little attention, when considering its importance, as that of fuses and their appliances.

In the first attempts in the application of fuses and fuse blocks great trouble was experienced owing to use of wood for blocks, too short space between terminals, arcing, heating from insufficient carrying capacity of screws and terminals. Troubles of a serious character manifested themselves, due to these defects, resulting in burning or charring of wood, loosening of contacts, and in many instances the total destruction of the entire fuse block. Porcelain was finally adopted as the means for overcoming the objections inherent in the older wood fuse block. The old troubles continued, and changes have been made from time to time in the terminals, screws, distances between terminals, and other details.

For several years instances have come to my knowledge where the line, although properly fused, has been seen to give off smoke, followed by the virtual roasting and destruction of the insulation. Investigation proved that this was due solely to the sluggish action of the fuse when the circuit was either overloaded or short-circuited.

Alloys of different compositions have been used, in which, experience has proved, some chemical change takes place, either from oxidation or action of current, resulting in variation in fusing current required. In some instances to my knowledge the fuse has blown far below its rated capacity, thus making a temptation for users to fuse higher than good judgment would dictate.

Owing to the repeated cases in my experience, such as burned-out fuse blocks, charred insulation on wires,



STUDY OF THE FUSE PROBLEM AND SOLUTION (TEST 23).

burned gas-pipes, etc., the grave fire risk attendant upon the use of fuses and fuse blocks has continually obtruded itself upon me, and has led me to examine into the subject of fuses and their appliances very carefully.

The gross unreliability of fuse metals and the lack of dependence to be placed upon the best designed fuse blocks used in practice has forced me to the opinion that in all cases of over 10 amperes capacity fuses and their appliances, while generally operating as desired, under certain conditions, however, are a serious fire risk, not only in themselves, but in their failure also as a protector.

As some criticisms have been made concerning my opinions for some time past, the following tests and quotations from authorities upon fuse metals are herewith given to emphasize the claims of the writer as to the gross unreliability of fuse metals and the fire risks attendant upon their use in all cases over 10 amperes capacity. Further, the tests show the lack of dependence to be placed upon the fuse blocks used in practice.

The following tests have been made in Philadelphia, January 14, 1896, across the terminals of a 100 light 110 volt dynamo. A Weston ammeter, a water rheostat, a main switch and the fuse blocks were all in series; a short circuiting switch around the fuse was used in most instances, permitting the current adjustment with water rheostat before throwing current upon the fuse to be tested. In all instances commercial fuse blocks and standard fuse metals were employed.

(1) Standard 30 ampere double-pole cut-out strip fuse, main line, five light standard link fuse 3½ amperes; the dynamo magnetic circuit breaker set at 25¾ amperes current. Twenty-six and one-half amperes passed through fuse and breaker five consecutive times and protecting fuse, fifth time blew fuse but did not open breaker.

(2) Five light fuse, 3½ amperes, blew at 26 amperes.

(3) Five light fuse or 3½ amperes, 10 to 12 tests on fuse without blowing with current of 27 amperes opened current breaker every time. After this 15 amperes was run through same fuse for 1½ minutes, heated fuse slightly but did not blow, then same fuse carried 40 amperes for nine seconds, and became red-hot before blowing.

(4) Ten light standard link fuse, seven amperes; held 15 amperes for 40 seconds, became red hot, then blew.

(5) Ten light standard link fuse, seven amperes, carried 14¼ amperes three minutes and 10 seconds, maintained red heat two minutes of that time before blowing.

(6) Fifteen light standard link fuse, 10½ amperes, circuit breaker 40½ amperes, opened six times without perceptible change in fuse; then this fuse carried 40 amperes 28 seconds.

(7) Fifteen light standard links, 10½ amperes, circuit breaker set at 40½ amperes. The fuse carried 40 amperes five seconds and became red-hot before blowing.

(8) Twenty light standard link fuse, 14 amperes, carried 40 amperes 18 seconds, white flame, arced for some time before breaking circuit.

(9) Twenty light standard link, 14 amperes, fuse block covered with mica, carried 40 amperes 18 seconds; heated, burned mica badly before blowing.

(10) Twenty light standard link, block covered with mica, carried 40 amperes; mica burned about half way through, time 22 seconds.

(11) Twenty light standard link. Same as before; current 40 amperes, time 32 seconds; burned mica still farther.

(12) Thirty light standard link fuse, 21 amperes, covered with fresh mica; main circuit breaker after 50 seconds carried current from 40 to 43 amperes; fuse showed dull red before blowing.

(13) Same fuse, 21 amperes, as before; mica covering new and clean; carried current of 45 amperes 55 seconds, damaged base. The standard block replaced with 25 amperes branch block.

(14) Fuse, 15 ampere standard, carried 40 amperes one minute, then arced for at least 10 seconds. The block was lying on back.

(15) Fuse, 15 ampere standard, block vertical lying lengthwise, carried 40 amperes 28 seconds, then fused and arced 32 seconds, cracked lid, composition ran out back, block cracked from heat, vicious, continued arcing, destroyed the block.

(16) Standard main line 25, lying lengthwise, fuse 15 ampere, edge of block forming a shelf for fuse and covered; current carried 40 amperes two minutes, 45 amperes one minute; showed only slight variation in color. Current withdrawn.

(17) Same fuse, 15 amperes standard, one minute carried 40 amperes, next minute 45 amperes, slight change in color. In this test the block was turned on short end, edge of block forming a shelf for fuse, as before, and horizontal. Current withdrawn.

(18) Block uncovered; same fuse, 15 amperes, not touching block, carried 40 amperes 35 seconds and blew; block standing on short end, fuse vertical.

(19) Fifteen ampere fuse, standard, same block; covered, lying on back in proper position as on ceiling, fuse touched lid, carried 45 amperes for 20 seconds, then arced with 27 amperes 33 seconds; burned seriously, vicious, continued arcing destroyed the block.

(20) Standard main line double-pole 30 light link standard fuse, 21 amperes, block face (mica) down, carried 40 amperes one minute, 45 amperes for the next 50 seconds, blew against mica.

(21) Same block, same fuse, in same position; 45 amperes, 22 seconds; blew with small arc against mica.

(22) Same block, in same position, against mica, 15 amperes standard, carried 45 amperes; blew in 17 seconds.

(23) Ten amperes branch block, 10 amperes standard fuse, stood on its side, fuse horizontal, cover on, carried 35 amperes and blew in five seconds; arced for 35 seconds; current in arc dropped from 28 to 18 amperes; arcing vicious, block destroyed (see cut).

(24) No. 2165 standard plug, block face down, three-wire main line, 40 amperes to light plug, carried 20 amperes five seconds, actual carrying capacity of fuse 5½ amperes; practically 500 per cent overload.

(25) Same block, 15 light standard plug, two amperes standing on narrow end, face exposed one minute, 20 amperes, next 30 seconds 25 amperes, next 30 seconds 40 amperes; blew.

(26) Same block, face exposed, block lying on back, 50 light fuse, 10½ amperes, carried 30 amperes one minute, 45 amperes 1½ minutes, 50 amperes one-half minute and blew, 400 per cent overload.

(27) Repetition of 26 with same results.

The following tests were conducted in the power station of the University of Pennsylvania, January 17, 1896, by courtesy of Prof Spangler. Connections and instruments similar to tests made January 14th were used. Connections were made across leads of a 110 volt 500 light dynamo. The tests as shown herewith are exceedingly interesting, as they were made upon larger fuse metals and fuse blocks than in test of January 14th.

(28) Standard branch block of 30 amperes, 30 amperes standard fuse carried 60 amperes three minutes, 65 amperes one minute, 70 amperes one minute (no discoloration noticed), 75 amperes one minute (standing upright).

(29) Same block, same fuse; 80 amperes one minute, 85 amperes one minute, 90 amperes 45 seconds; blew and arced four seconds, burned hole in mica.

(30) Same block as No. 28, 30 ampere standard fuse, touching mica; carried 100 amperes 12 seconds.

(31) Same block as No. 30, 30 ampere standard fuse, touching mica, block face down; current increased gradually to 75 amperes in 22 seconds.

(32) Block upon edge standing upright (same block as No. 28), 30 ampere standard fuse, carried 80 amperes 20 seconds.

(33) Same block, 30 ampere standard fuse link, carried 40 amperes one minute, 45 amperes one minute, 44 amperes two minutes 20 seconds; kept red until current was withdrawn.

(34) Standard link fuse block, main line double-pole, 50 ampere, fuse block resting on bottom; 50 ampere standard fuse carried 70 amperes 45 seconds, 75 amperes one minute, 80 amperes one minute, 85 amperes two minutes, 90 amperes one minute 10 seconds, 95 amperes one minute 20 seconds, 100 amperes one minute 30 seconds, 105 amperes one minute 10 seconds, 110 amperes one minute 53 seconds, 115 amperes one minute 10 seconds, 120 amperes one minute, 125 amperes two minutes, 130 amperes two minutes 15 seconds; arced one minute seven seconds. No. 6 copper leads became hot, followed by insulation running, serious heating of wire (note size of wire), destroyed block.

(35) Standard 50 ampere double-pole main line fuse block, 50 ampere standard fuse; fuse block upon its side; carried 70 amperes two minutes, 75 amperes one minute, 80 amperes one minute, 85 amperes one minute, 90 amperes one minute, 95 amperes one minute, 100 amperes one minute, 105 amperes one minute, 110 amperes one minute, 115 amperes one minute, 120 amperes one minute, 125 amperes 20 seconds, arced three seconds; mass of molten metal laid in bottom which arc could have passed over.

(36) Same block, new side, 40 ampere standard link fuse, rated to blow at 50 amperes; carried 50 amperes one minute, 55 amperes one minute, 60 amperes one minute, 65 amperes one minute, 70 amperes one minute, 75 amperes 30 seconds; slight arc.

(37) Same block, 50 ampere standard wire, lengthwise position, carried 75 amperes one minute, 80 amperes one minute, 85 amperes one minute, 90 amperes one minute, 95 amperes one minute, 100 amperes one minute, 105 amperes one minute, 110 amperes one minute, 125 amperes 13 seconds; arced 13 seconds, destroyed block.

The following are quotations from various sources and authorities bearing upon fuse metals in general:

A prominent fuse wire company's catalogue says: "The fusion necessarily depends upon all the elements that effect this heating. It takes time to heat even a wire, and people are sometimes greatly disappointed because a fuse does not open a circuit with the rapidity of a photographic drop shutter the instant there is a sudden increase in load. It also shows, however, that on account of the time required to heat the fuse to melting point, one cannot expect it to do the work of an automatic cut-out, which opens the circuit instantly at a set strength of current. If sudden increases in current cause other serious troubles, an automatic cut-out is wanted—not a fuse."

Prof. W. M. Stine, H. E. Gaytes and C. E. Freeman, in a paper on "The Heating and Behavior of Fuse Wires,"[1] read before the American Institute of Electrical Engineers, October 23, 1895, say: "We may now summarize some of the practical conclusions deduced. Covered fuses are more sensitive than open ones. Fuse wire should be rated for its carrying capacity for the ordinary lengths employed. When fusing a circuit the distance between the terminals should be considered. On important circuits fuses should be frequently renewed. The inertia of a fuse for high currents must be considered when protecting special devices. Fuses should be operated under normal conditions to ensure certainty of results. Fuses up to five amperes should be at least 1½ inches long, one-half inch to be added for each increment of five amperes capacity. Round fuse wire should not be employed in excess of 30 amperes capacity. For higher currents flat ribbons exceeding four inches in length should be employed."

From a paper entitled "Property of Fuse Metals

1. Report presented to the Board of Fire Underwriters at Philadelphia.

1. Abstracts from the discussion of this paper are also quoted by Mr. McDevitt.

when Subjected to Short-circuits,"[1] presented to Niagara Falls meeting of the American Institute of Electrical Engineers by Walter E. Harrington, this paragraph is taken: "The natural conclusion arising from a knowledge of the above data is that fuse metals are under no circumstances to be considered in the light or nature of a protection."

LESSONS

*First*—Fuses carry 50 per cent. to 200 per cent. current in excess of rated fusing current. See tests.

*Second*—Under "short-circuits" a fuse will carry excessively abnormal current. See tests Nos. 1, 3, 6, 7, 38.

*Third*—Fuse metals made of alloys, so as to have a low temperature melting point, will maintain at a red heat, making a serious fire risk. See tests Nos. 3, 4, 5, 7, 8, 12, 33.

*Fourth*—Copper, aluminum, iron, etc., are not adapted for fuse metals, owing to the high temperature required for fusing. To be reasonably sensitive, they must be maintained at a red heat, which is not permissible owing to fire risk.

*Fifth*—Fuse metals arc and make a serious fire risk. See tests No. 14, 15, 19, 21, 23, 34, 35, 37. This phenomenon was very pronounced using different length fuses, and placing fuse blocks in different positions. In my judgment this is a fault inherent in fuse metals, due to the fact that the molten metal can still carry current and the arcing will jump across the slight distances intervening between the terminals and the molten metal, although an arc can be maintained without the presence of the molten fuse metal.

*Sixth*—Enclosing a fuse is not safe, as the gases generated upon the fusion of the metal will continue to carry the current in event of a short-circuit. See paper read before the American Street Railway association at Atlanta, Ga., entitled, "Destructive Arcing of 500 Volt Fuses."

*Seventh*—Fuse metals are very sluggish in fusing, and in this particular make a serious fire risk, as the current flowing in many instances permits the wire under insulation to become hot, or intervening space between wires, if a leak arises, to become hot. See tests No. 34, 35, 36, 37.

*Eighth*—Fuse metals are generally unreliable, as their position, length, age, oxidation, shape, composition, temperature, terminals, all affect their fusing point. No standard fuse block and fuse could be established, but that some of these factors would enter to cause a variance in the results. See tests 28, 29, 30, 31, 32, 33.

REMEDY.

Attempts were made in the early days of electric lighting to use automatic magnetic circuit breakers in place of fuse metals. Owing to the lack of proper mechanical design of these early electro-magnetic safety devices, their use was abandoned. In the last few years, however, as a substitute for fuses automatic magnetic circuit breakers have been adopted in power transmission, railway work, isolated lighting plants and storage battery installations, independently of any requirements of boards of fire underwriters, as engineers have long realized by practical experience the untrustworthy character of fuse metals. I have made a careful detailed investigation, visiting power stations where the modern magnetic circuit breakers are used, and have also made personal tests. While I have found certain faults in the design and mechanical construction of some of the magnetic circuit breakers now in use, in no instance are these faults comparable to the more serious inherent faults in fuse metals.

An automatic magnetic circuit breaker depends for its action upon the magnetic quality of the current. This action is instantaneous. A fuse depends for its action upon the heating quality of the current. This action is necessarily slow, and it is inherently foreign to the purpose for which the fuse is intended, to-wit, protection. I believe automatic magnetic circuit breakers should be employed to protect all circuits over 10 amperes capacity.

After carefully considering the several features in principle and design of automatic magnetic circuit breakers, I believe that a device embodying the following particulars would be an entirely satisfactory electro-mechanical device for the protection of electric circuits:

*First*—A magnetic circuit breaker wherein no springs are permitted in its adjustment. Adjustment should be effected by means of distances.

*Second*—It should have the feature of opening the circuit in less and less time as the conditions of the circuit protected approach a short-circuit. The electro-magnetic part of circuit breakers should be designed to develop more energy than is necessary to trip retaining catch. The additional energy developed should be applied directly to aid in opening the switch. It immediately follows from this that as the current flowing through the device exceeds the amount of adjustment, the switch will, of course, be more quickly and positively opened.

*Third*—The magnetic circuit breaker should be so constructed that with the minimum current flowing through it necessary to open it, the plunger or armature, if it moves at all, that the blow struck or power exerted, under all conditions, should be such that the switch will open.

*Fourth*—The electro-magnetic mechanism wherein any insulation enters into the construction of the trigger or catch, should not be permitted, owing to the tendency of the insulating composition to ultimately break down.

*Fifth*—It would seem desirable to have the magnetic circuit breaker so constructed that in event of the circuit breaker opening, owing to overloaded condition of circuit, that if the same overloaded condition continues at the time the circuit breaker is thrown in, the catch will not engage.

*Sixth*—Where magnetic circuit breakers are to be employed in damp places, all bearing pins and parts liable to be affected by rust should be of phosphor bronze and moving iron parts plated.

*Seventh*—The armature or plunger of the magnetic circuit breaker should not be permitted to act on the retaining catch or switch arm, unless a free preliminary movement precedes such action. The reason for this is apparent, as the adjustment would be then affected by the friction of catch or arm.

In conclusion, to condense the above features to form a specification to cover what would constitute an approved automatic magnetic circuit breaker, I submit the following:

*First*—The magnetic circuit breaker must have the features of opening the circuit in less and less time as the conditions of the circuit protected approach a short-circuit, that is, have an inverse time element. The electro-magnetic part of circuit breakers must be designed to develop more energy than is necessary to trip retaining catch. The additional energy developed should be applied directly to aid in opening the switch.

*Second*—A magnetic circuit breaker wherein no springs are permitted in its adjustment.

*Third*—Insulation must not enter into the construction of the trigger or catch.

*Fourth*—All bearing pins and parts liable to be affected by corrosion or rust must be of phosphor bronze, and moving iron parts copper-plated.

*Fifth*—The armature or plunger of the magnetic circuit breaker must not act on the retaining catch or switch arm unless a free preliminary movement precedes such action.

1 Abstracts [illegible] Mr. Harrington [illegible] paper are also quoted by Mr. [illegible] paper by [illegible] at the Washington convention of the [illegible] Light [illegible] "Faults Incident to the Protection [illegible] Lighting and Power Circuits," which was printed [illegible] March 17, 1891.

## Economy of the Detroit Municipal Plant.

Probably Detroit, with its large and recently installed arc light plant, is in the best position of any of the large cities of the country to thoroughly test the efficiency of municipal station lighting. Alex. Dow, an honest and capable engineer, is in charge, and the plan is being given a fair trial. Nevertheless, the economy of the change is called in question by competent critics, and Mr. Dow seems careful not to deny that the cost to the city per light per year amounts to $120. This is in decided contrast to the unfair, bombastic claims of the advocates of municipal control of the Barrett stripe. The controversy over the Detroit plant is very interesting, and will be found valuable by the readers of the WESTERN ELECTRICIAN. The attack on the municipal system is well represented by the following letter in the *Detroit Free Press*, from the pen of C. Livingston of St. Paul, Minn.:

In your issue of Friday, January 10th, you give the average cost per lamp per month of the public arc lights of the city of Detroit at $7.20. I am always at a loss to know what advantage it is to an individual or a municipality to deceive him, or itself, which you certainly do, and which Detroit certainly does in the statement you publish. In the detailed statement of the cost of operating the public light plant which you give, the question of depreciation of the plant, insurance, water and also taxes are all eliminated. The figure $1.34 is the interest charge per lamp per month. If I am correctly informed the plant cost $650,000; interest, even at four per cent., would amount to $1.46 instead of $1.34 per lamp per month. Taking, however, your own figures of $1.34, plus $5.86 for the items you mention, gives the figures you state, $7.20 per lamp per month. I am informed that the value of the real estate is $145,000. Taking this from the total cost of the plant ($650,000) would leave $505,000 as the cost of the machinery. It is the consensus of opinion of the best electrical experts that depreciation in electrical machinery is at least 10 per cent. a year. Say, however, the value of the machinery is $400,000; 10 per cent. of this is $40,000; to this add the cost of insurance, say 1½ per cent. on $545,000, which is much below the going rate of insurance on electrical machinery, and you have the total cost of these two items, $48,175, which, divided by 1,483, average of lamps in use during the months you enumerate, would give the cost per lamp per year as $32.48; dividing this again by 12 and you find the cost per lamp per month is $2.70 for these items, adding this to the $7.20 as given above, gives us $9.90 per month as the cost of each arc lamp. Multiplying this by 12 (the number of months in the year) gives us the cost per year for every arc lamp at $118.80. If the interest figure which I give above as $1.46 is correct, the cost per year would be $120.24. I am told that the assessed value of property in Detroit is about 80 per cent. of its real value, on which the city receives a tax of two per cent. If this be true, the assessed value of your electric lighting plant would be $520,000, two per cent. on which is $10,400. The loss of this tax should be added to the cost of your lights, for the reason that if the municipality did not own its own plant, some private corporation would, and the city would receive the tax above stated. There are various other items of expense which experience shows every electric light plant, whether owned by individuals or municipalities, are the natural sequences of the business, such as patent and personal damage suits. In fact, in a railroad company, of which I am a director, a certain per centage of our gross earnings is credited to the fund to pay for personal damages each year, and the amount so credited does not equal the amount paid for personal damages, and in an electric lighting company that I was formerly connected with, in a much smaller town than Detroit, in 11 years' time the smallest amount paid for personal damage cases in the form of legal expense and settlements, in any one year, was in excess of $6,000.

At this distance I am quite likely to make some minor errors regarding your plant, but, in the main, the statements that I give above are correct, and when the statement is made to your people that the cost per lamp per year is $86.40, they are being deceived, unintentionally doubtless, but none the less deceived. I am sorry to say I have neither the time nor opportunity, and I may say the inclination, to discuss this subject. I have no doubt my few remarks may elicit many replies in contradiction of what I state, but I am satisfied that any good, sound business man in your city will see that the statement, as made in your paper of the 10th, is not borne out by the facts, if he would take the trouble to investigate it.

To this Mr. Dow makes this defense:

The communication of Mr. Livingston shows that the many readers of the *Free Press* who are not residents of Detroit and naturally not familiar with the financial system of the city, may misunderstand and be deceived by the figures published of cost of public lighting. The residents and taxpayers, to whom the publication is primarily addressed, expect from the lighting commission only a statement of actual expenses from the public lighting fund and interest fund; and (to quote your correspondent) "any good, sound business man" of the city can add to these items of cash expense the figures for depreciation, loss of taxes etc., which he thinks right. The costs are published for exactly what they appear to be, namely, those costs of a public lighting plant which come out of the annual tax levy. That the taxpayers do calculate depreciation, loss of taxes, etc., is a matter of common knowledge to the *Free Press* and to the lighting commissioners; and Mr. Livingston's letter is eminently proper in that it tends to educate the greater public outside of our own city in the precise knowledge of lighting costs, which long discussion and some experiment has brought to the home public.

Mr. Livingston's argument is generally correct. The minor errors which he thinks he may have made are numerous and invalidate his final figures; but taking the figures as he makes them—namely, $120.24 per lamp—there is still a saving to the city of $12 per lamp per year as compared with the last contract.

But that is not the whole story. Even if a new contract had been made at such a price as would equal the cost of the municipal operation, plus interest, sinking fund, depreciation, loss of taxes, etc., under the contract system at the end of 30 years, that is, to say at the coming due of the lighting bonds, the city would have had 30 years lighting for its money. Under the municipal system, with the accounts kept as Mr. Livingston proposes, the city would have had the lighting, and also would own, free from encumbrance, a lighting plant in good running order and a depreciation fund of such amount at that instant as to restore the plant to its original value.

And still there is more of it. For, under the contract system, the equivalent to the sinking fund and depreciation fund is paid in equal annual installments to the contractor, in whose hands these installments would lie until their investment becomes necessary. Under the municipal system these moneys remain in the taxpayers' hands until called for and the taxpayers have the use and benefit thereof. This is no small item. Just figure it at compound interest on the assumption that the money is even paid into a savings bank instead of being used over and over in the active business of the taxpayers.

The same reasoning applies to the fire insurance. The city is so large a corporation that it can profitably carry its own insurance, and as a matter of fact the lighting plant is a very good risk.

Now for the minor errors. The interest charge is $1.34 per month; the bond issue is $600,000; the remaining capital was raised by direct tax. This explains the difference Mr. Livingston notes, but he is, of course, justified in figuring interest on the total capital.

The water supply is obtained by a direct gravity connection with the river, which connection is charged to capital. The water costs nothing, Uncle Sam making no charge for the water and gravity running it into the well.

The difference between $145,000, the value of real estate, and the total capital is not entirely electrical machinery subject (perhaps) to a 10 per cent. annual depreciation. There is less than $100,000 worth of electrical machinery, all told. There is $85,000 worth of steam machinery—engines, boilers, piping, foundations, etc.—which 20 years actual experience shows to have a depreciation factor of about five per cent. on gross cost. There is $82,000 worth of towers, which, by 10 years' actual experience, are shown to have a depreciation factor of about four per cent. There is $82,000 in conduits, which, judging by experience with sewers, has a factor of two per cent. or 2½ per cent. There is $100,000 in pole lines and overhead construction, which 30 years' experience has shown to have a depreciation factor of about seven per cent. Allow these factors of depreciation instead of an average factor of 10 per cent.—even correct them, if you will, to suit your own ideas, and there will be a big reduction in Mr. Livingston's depreciation charge.

As to the taxes lost, that is easily corrected to local conditions by taking the reduction of assessment allowed

the late contractors and adding thereto the taxes formerly paid on the land now occupied by the lighting plant. The total divided among the lamps operated is just $2 02 per lamp per year.

Lastly, the cost of possible injuries to person or property must be considered. Mr. Livingston takes the ground correctly hereon. If the city insured in a casualty company, as do many private concerns, it might be possible to express this in a round sum per annum. Not having such insurance, the estimate is difficult to make. But to show that it is not overlooked I beg to say that the operating cost lately published by the *Free Press* include, a premium for insurance on the boilers and for damage to person or property that might be caused by an explosion thereof; and that the full pay of four men, employes of the city, partially or totally disabled by accident during the last three months, together with the medical and surgical attendance they required, is included in the statement under the head of "Labor and Management."

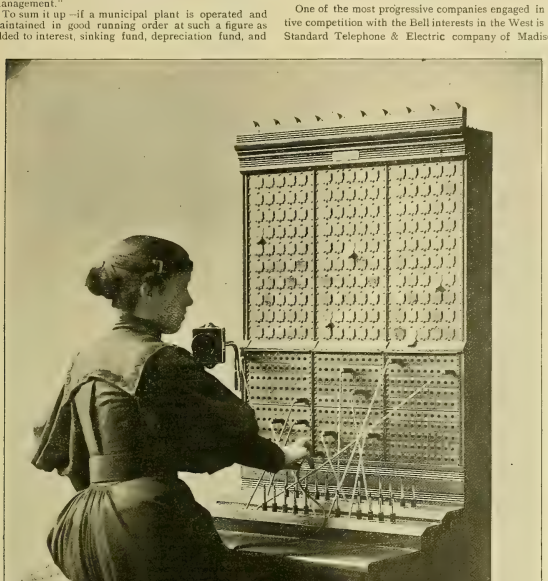
To sum it up—if a municipal plant is operated and maintained in good running order at such a figure as added to interest, sinking fund, depreciation fund, and lost taxes, will equal the contract cost of lighting, there is a gain to the taxpayers in municipal lighting. Directly, by reason of the ownership of a marketable asset, free from incumbrance, at the winding up of the sinking fund; and, indirectly, by the retention of the depreciation fund in the active business of the taxpayers.

## First Baldwin-Westinghouse Electric Locomotive.

The first electric locomotive constructed at the Baldwin Locomotive Works, Philadelphia, for the Baldwin-Westinghouse combination, has arrived at the Westinghouse Electric company's yards at East Pittsburg, Pa., where the electric motors are being placed upon it. The locomotive is of the regular standard passenger size of 1,000 horse power capacity. In appearance it does not resemble in the least the ordinary locomotive, says the *Iron Age*, but looks like a passenger car, measuring 36 feet in length and nine feet across. All the operating parts of the locomotive are placed under the body of car, giving ample room above for the storage of freight. The engine has eight wheels, each 42 inches in diameter, and the truck is built exceptionally strong on account of the heavy weight in the shape of the motors it will have to carry and for the arduous work it is expected to perform. The locomotive weighs 160,000 pounds, and its hauling capacity is calculated to be about 65 per cent more than that of steam locomotives, although the latter weigh on an average 200,000 pounds. The electric equipment of the locomotive consists of four 250 horse power motors, made by the Westinghouse company, which are geared so as to regulate the speed. It is stated that this locomotive cost less than one-third of those used in the Baltimore tunnel by the Baltimore & Ohio railroad, the price of each of which was $50,000. The engine is geared to run at the speed of 75 miles an hour. This initial locomotive will be used on the Turtle Creek branch of the Pennsylvania railroad.

## Standard Telephone & Electric Company's Switchboard.

One of the most progressive companies engaged in active competition with the Bell interests in the West is the Standard Telephone & Electric company of Madison, Wis. It should not be inferred, however, that because this is a western company its operations are confined to the western territory exclusively, for as a matter of fact it has installed its apparatus in every part of the country, the East and the South as well as the North and the West. In every case, too, it may be added, those operating the Standard apparatus speak highly of its efficiency, reliability and the economy of operation. The company is prepared to furnish complete equipment for exchanges of all sizes, and the excellent outfits that it has already installed afford the best possible evidence of the company's ability to turn out first-class apparatus.



STANDARD TELEPHONE & ELECTRIC COMPANY'S SWITCHBOARD.

The accompanying cut gives an excellent idea of the appearance of the company's new switchboard. In this, as in all other apparatus employed by the Standard company, the apparatus as well as the method of operation is exceedingly simple. To illustrate the system of connecting subscribers the following explanation will suffice:

Supposing drop 20 falls, for instance, and the operator plugs into 20, upper row of spring jacks, and ascertains that 50 is wanted, this movement being made with the listening plug. The farthest plug from the board (of any pair of cords) is then inserted in 50, also of the upper row of jacks, the hand generator being turned before the second plug of the pair is picked up from the inner row. This rings 50. After ringing, the inner plug is picked up and inserted in 50, lower row of jacks. Hence, where a hand generator is used, but four moves are required for the operator to answer a call, ring number wanted, and connect the lines, and no further move is necessary to ascertain that the subscribers are in communication. Where a power generator is used, but three moves are necessary to accomplish the same result, as ringing is done automatically when the first plug of the pair of connecting cords is inserted in the spring jack of the number wanted. This result is obtained by the use of the clearing-out system adopted by the American Bell company, in such a manner that the claims of the patent are not infringed, and the work is done just as quickly and well in the following manner: The drops are cut in only on the lower row of spring jacks, being cut out of the upper row. In making connections, the subscriber making the call is always plugged into the lower row of jacks, and when the "ring off" comes in, the drop on the line falls. Thus the operator has but one drop to replace, and the resistance of but one drop is cut into line.

## Electric Light on Board Nansen's Ship.

While one portion of the scientific world is following with fascinated interest the development and experiment of the new form of radiation to which Prof. Röntgen called attention, another is dwelling with equal delight on the possibility of truth in the report that Dr. Nansen, the Norwegian explorer, has in fact reached the North Pole and is even now safely returning home. Dr. Nansen's preparations for his voyage were most complete. He and his twelve companions were provisioned and equipped for a period of five to six years and set sail in a small vessel so constructed, in theory at least, that when fairly in the grasp of the rigor of the northern seas the ice would not crush it but would bear it up. The theory of the expedition was that the ship, once packed in, or lifted on, the ice, would drift slowly, possibly for years, toward the Pole in a current that Dr. Nansen had theoretically demonstrated to exist. But what illumination was depended upon for the hardy adventurers during the long Arctic winter nights? Nothing less than the electric light. The manner of generating the current can be best described in Dr. Nansen's own words, taken from an exceedingly interesting article contributed to an English magazine:

I have already said that we have a snug saloon to live in, and we have electric light to make us forget the absent sun. But many will perhaps ask how we shall get the necessary power to produce the electricity, as we could not afford to burn coal for that purpose. This is not, however, so very complicated. On one hand we have the wind, and by the help of a big windmill we shall be able to work the dynamo, and by the help of our accumulators we shall be able to store up electricity for some time when we get a gale. But when there is no wind, we have ourselves. We are 13 men, and when a capstan is arranged on deck we shall be able to do work similar to that which a horse does in its horse-mill on land. In this capstan four men take their turn at a time; thus we shall obtain good and regular exercise, and be useful at the same time. When the sun disappears and the long night comes on, we shall take our walk in a ring on the deck of the Fram to produce our own sun. In this way man must conquer nature. But I dare not say for certain that we shall not long for the natural sun, and look eagerly forward to its appearance again in the dawn of spring. Then it will rise slowly and majestically over the horizon, and pour its blessed light into our souls.

It is a dull imagination indeed that cannot conjure up, from this description, a mental picture of the most unique electric light plant in existence. It is in truth, as the explorer says, a spectacle of the intellect of man arraying some of the forces of nature to aid in wringing from it jealously guarded secrets. One of the party, it may be added, Bernhard Nordahl by name, is an electrician.

## Concrete Foundations for Street Railway Tracks.

City Engineer McClintock of Rochester, N. Y., is endeavoring to secure concrete foundations, in the shape of a bed of the material six inches thick, under the ties of the street railway tracks in that city. He believes that such a foundation would be a great benefit to the street, where expensive pavements are laid, and that incidentally the danger from electrolysis may be averted to some extent. In a letter on this subject City Engineer Benzenberg of Milwaukee says:

"Last year the street railway company decided to put

in such foundation under tracks which are to be relaid on streets that were to be repaved. Their experience has been such that of their own accord they have admitted their mistake in refusing to put in concrete where required two years ago, and are now preparing to take up the tracks on those streets and relay them upon a six-inch bed of concrete under the ties. Experience has forced them to this conclusion, and it seems to me that it ought not to be very difficult for any street railway man experienced in the construction to see the benefit of a rigid foundation for a track which is called upon to sustain the heavy load and service of the electric street railway car.

## Value of Wilson's Acetylene Gas Patents.[1]

By John I Beggs.

Some friends of mine in New York who were considering buying the right for certain populous states, for the purpose of going in there and exploiting and selling county rights, had some of the best patent lawyers of the city of Washington examine into the patents, and their opinion was that there was no patent, and that there is nothing to prevent any electric lighting company in the United States, or anyone else who chooses to attempt to make this calcic carbide, from entering into its manufacture. What Mr. Wilson did was simply to discover a process—a much cheaper process, it is claimed, than the ordinary one—of manufacturing the gas. Previous to this its manufacture has been very expensive, and I seriously question in my mind whether even now the carbide can be made in large quantities for less than $100 per ton; and at that rate you can readily see that it is no competitor whatever, even for ordinary illuminating gas, to say nothing about the electric light, because at that cost it would represent about $1 per thousand cubic feet for ordinary illuminating gas. There are many gas companies putting the gas into their holders for as low as 17 cents per 1,000 feet, as the cost of production, and that, gentlemen, is the point which you have got to contend with in calculating what you can sell an incandescent lamp for. What does the current cost that is going through that filament to produce the light? I know a number of gas people who thoroughly investigated this matter several months ago, and concluded that it was no menace to their business, and that they did not want any rights to produce or manufacture acetylene gas.

## Apology Unnecessary.

[From the London *Electrician*.]

Our Chicago contemporary, the Western Electrician, in its issue of January 11th, comes out with a quite unnecessary apology for "a day's delay and the slightly changed appearance of the paper," due to a fire which took place on the previous Saturday, and by which the composing room was completely gutted. We diagnosed the condition of our contemporary as "normal" until it gave us an insight into the very abnormal conditions amid which its issue of January 11th had been brought out.

# CORRESPONDENCE.

## New York Notes.

New York, February 15.—The Legislature in Albany has been giving much attention to street railway matters. The Assembly committee appointed to inquire into the question of municipal ownership of railroads and of the organization, construction and operation of elevated and surface railroads in cities has presented its report through its chairman, S. Fred Nixon of Chautauqua county. The committee found flagrant instances of over-capitalization and proposes remedial legislation. The suggestive features of the report may be thus summarized:

The committee recommends limiting the power to issue stocks and bonds by street railway companies to a stated sum and, further, the passage of a bill which would require all the street railway companies hereafter incorporated to obtain the consent of the railroad commissioners to the amount of the capitalization stated in the articles of incorporation.

On the subject of municipal ownership of street railways the preponderance of testimony and the great majority of opinions expressed were against the adoption of the system. In the committee's opinion with the present system of municipal government the ownership and operation of railroads by the cities would have a tendency to convert these enterprises into powerful political machines, the result of which would be detrimental to the public welfare.

The committee does not believe in making franchises perpetual, although confronted by the fact that most of them have already been thus granted. On this subject the committee recommends that a bill be passed providing that all franchises be sold by lease for a stated period, say 50 years, at public auction to the company offering the lowest rate of fare.

It is recommended that a bill be passed requiring every surface and elevated railroad in the state to sell tickets as low as [illegible] good between the hours of 6 and [illegible] and 7 [illegible] each week day whenever the earnings of any such road are sufficient to pay the operating expenses and fixed charges with a dividend of five per cent. upon its capital stock.

A system of transfers from one road to another belonging to the same company should be enforced by statute.

The making of a law for the proper heating and lighting of cars is also recommended.

As to fenders, the committee believes their use has been required on all cable and electric cars in the cities of the first and second classes and it urges placing on the statute books a law prohibiting one car passing another that has come to a full stop.

Bills were introduced to carry out these recommendations. It is pointed out, however, that the 3½ cent fare bill is defective in that companies are entitled to earn five per cent. on their stock before they are compelled to make the rate. It would be an extremely easy matter for a railroad company to swell its expenses, and thus keep the earnings under the limit, by erecting office buildings in the shape of power houses and by giving enormous salaries to the officers of the company. On the other hand, if no limit of protection for earnings were provided, grave injustice would be done in many cases.

Other "reforms" are proposed. One bill places the control of all street railroads in the state in the hands of the state railroad commission, so that no extension can be made without first securing the consent of the commission. Another proposes to regulate the pay of gripmen, motormen, drivers and conductors of cable, electric and horse cars throughout the state. It provides that all such shall be entitled to not less than two dollars a day, and any man who shall take a car out and make one or more round trips shall be entitled to full wages for the day. Some of the proposed laws are intended to benefit the public, while others appear to be merely sandbagging schemes. Perhaps few or none of these bills will be enacted, but their effect is to unsettle the street railway industry of the state.

It is reported and denied that the Metropolitan Traction company is trying to secure control of the elevated roads.

At a recent session of the Rapid Transit Inquiry commission David L. Barnes of Chicago told of the railroads with which he had been connected, and of his present work as consulting engineer to the Baldwin-Westinghouse combination of Philadelphia and Chicago, for the construction and sale of electric locomotives and apparatus. In reply to Mr. Shepard's questions, he explained the advantages of electricity over steam as a motive power and showed by photographs where steam locomotives had damaged and warped rails that had stood harmless under heavier weights drawn by electric motors. Mr. Barnes' testimony was to show to the commission that by the use of electric motors the probable vibration of which the opposing property owners complain will be reduced to a minimum, if not entirely done away with. Mr. Barnes contrasted the amount of fuel needed to generate the requisite electricity in a central station with that necessary to supply steam for an engine, and estimated that on the 18 miles of road shown in Mr. Parsons' plan the saving in favor of the electric motors would be at least 50 per cent. An electric motor, the witness said, attached to six loaded cars could reach a speed of 60 miles an hour in 47 seconds and within 2,700 feet of its starting point, and while going at that rate could be stopped within 1,500 feet.

W. F. O.

1. [illegible]

# PERSONAL.

C. C. Haskins, Chicago, has recovered sufficiently from his recent illness to permit him to return to business.

Col. W. S. Rogers of the Brush Electric company of Cleveland has been spending several days in Chicago and vicinity.

Thomas R. Mercein of Milwaukee was in Chicago last week upon business relating to the Northwestern Electrical association.

C. A. Benton of the Sprague Electric Elevator company of New York was a Chicago visitor last week. Major Benton was welcomed by his old friends in this part of the country.

C. R. McKay, a prominent electrical engineer of Salt Lake City, visited Chicago last week for the purpose of examining several plants in this city possesisng features of special interest to him.

Assistant General Manager S. Dana Greene of the General Electric company is taking a vacation by a trip to Caracas, Venezuela, where he will remain a few weeks. This is the first vacation Mr. Greene has taken for over six years, having applied himself in the closest manner to the important position which he holds in the General Electric company, with the result seen in the progress of the business of this concern. His many friends in the electrical trade will join in wishing Mr. Greene a pleasant trip and a safe return.

# ELECTRIC LIGHTING.

A Bridgeport, Conn., dispatch states that the Bridgeport Electric Light company has voluntarily reduced the price of electric lights furnished to that city from 33 cents a light to 30 cents. The city will therefore proceed to erect and maintain enough more lights to make up the total amount of the appropriation of about $40,000.

Sealed bids will be received by Sumner T. Bisbee, clerk of council of the city of Keokuk, Iowa, until noon of February 21, 1896, for lighting the city of Keokuk with 140, more or less, arc lights, in accordance with specifications now on file with Mr. Bisbee. The contract is to be for the term of five years from and after May 3, 1896.

A New Haven paper states that the Berlin Iron Bridge company has erected an electric light plant, and will soon light the whole town of Berlin, Conn., by electricity free. The company does this for the benefit and the protection of its plant as well as for the benefit of the town. The company has made application to the Southern New England Telephone company for permission to run its wires on the poles of the telephone company, and it has been granted.

Contracts have been awarded to the Chicago Edison company for supplying the electric lighting apparatus for the temporary postoffice at Chicago, at a cost of $2,387, with a proviso that the work of wiring the building shall be completed in 20 days. The general illumination will be supplied by low-tension arc lamps, and incandescent lights will be used in the offices and over the sorting and stamping tables.

The Holyoke, Mass., Water-power company has just put in a new 2,000 light electric generator for the incandescent circuits from the power and light station. The Edison generators, which have been used, were not large enough to take care of the business that was being done, and it was necessary to add a new machine. The new generator will be used on the incandescent circuits on the hill, and the lower part of the city will be served by the Edison generators.

The ultimate destination of the 10,000 light Westinghouse alternators in the service plant in machinery hall at the World's Fair has excited much conjecture. It is interesting to learn that the Westinghouse company recently furnished four of them to the United Electric Light & Power company of New York city, and they are furnishing current for lighting a considerable portion of the metropolis. Several others are installed in the plant of the Brush Electric Light company at Baltimore, while the rest are distributed in several large electric light plants throughout the country.

The contract for the lighting of the streets of Columbus, O., has been awarded to the Citizens' Light, Heat & Power company. The minimum number of lights under the contract is 800, but it is understood that until January 1, 1897, the lights are to be run on the moon table system, and thereafter on the all-night plan. For the eight months ending January 1, 18 97, the price to be paid is $38,400, and the total for the nine years thereafter, $703,800; on the basis of 1,000 lights the figures would be $918,150. The successful company is composed of R. T. McDonald, C. S. Knight, Ralph Rickly, David C. Beggs and Thomas Cooper. The capital stock is $200,000 and is owned principally by McDonald and Knight, and the director (a municipal officer of Columbus) states that he investigated their manufacturing plant and found it a very large affair at Fort Wayne, with a pay roll of about $36,000 a month, and that the Fort Wayne Electric company has nothing whatever to do with the present company. Mr. McDonald, the director found, was possessed of several hundreds of thousands of dollars worth of property. In a short time the company to whom the contract has been awarded will ask the City Council for a franchise for commercial lighting in that city.

# ELECTRIC RAILWAYS.

The Consolidated Street Railway company of Grand Rapids, Mich., has announced a reduction in fare from five to 4¼ cents, to take effect March 1st. There had been no urgent demand for reduced fares in the city, and it is believed that the reduction was made with the single view of increasing the patronage of the road.

The officials of the Washington, Alexandria & Mount Vernon Electric Railroad company of Washington, D. C., have received advices that the General Electric company has completed the order for six motors for use on the line. General Passenger Agent Phillips told a reporter that these motors have a guaranteed speed of 60 miles an hour, which they are expected to develop on certain parts of the road. Through the cities of Washington and Alexandria, he said, the trains which the motors will draw will move slowly, but in the country, where there are no obstructions, the highest limit of speed that the motors are capable of making will be availed of, and the entire distance of 17 miles between the corner of Fourteenth street and Pennsylvania avenue northwest, Washington, and the gate at Mount Vernon will, it is expected, be covered in 45 minutes.

Arrangements are being made to established a street railway postal service between Chicago and Hammond, Ind. This will make Hammond one of the leading mail distributing points in Northern Indiana. The plan is to run a postal car direct from the Chicago postoffice to Hammond, not only to carry mail between the two points, but take on and put off mail at Englewood, Burnside, Hyde Park, Pullman, South Chicago, Roby, Whiting and East Chicago. The proposed route is over the

Hammond, Whiting & East Chicago electric line from Hammond to Roby, thence over the South Chicago street railway to Sixty-fourth street and Stony Island avenue, where it will be transferred to the Chicago City street railway, which will carry it direct to the Chicago postoffice. The plan has received the sanction of the postal authorities, and it is thought it will be put in operation in a short time.

While the trolley lines have proved a sharp competitor for the steam roads in passenger travel to and from the outskirts of Philadelphia and near-by suburban points, their effect upon railroad traffic has been nowhere so marked as in the northeastern section of the city, where both the Pennsylvania and Reading railroads have lost the greater part of their passenger business since the trolley car became their active rival. At Frankford, where the Pennsylvania railroad had a monopoly of the steam road business for nearly half a century, until the Reading's branch entered the town less than a year and a half ago, there has been a very marked change in the diversion of traffic between the steam and trolley lines during the last year, and since the reduction of fare to five cents on the electric roads most of the travel from Frankford and intermediate points has gone to the trolley lines, of which there are several that tap that territory.

## POWER TRANSMISSION.

The supervisors of Bakersfield, Cal., have given permission to the Kern River & Los Angeles Electric Power company to erect poles and wires along the roads of the county. This company proposes to convey electric power from Kern river, near Kernville, to Los Angeles, a distance of about 100 miles.

At a recent meeting of the Board of Trade of North Adams, Mass., W. S. Kelly of the General Electric company of Boston appeared before the board and outlined his scheme to utilize the waters of Deer Hill pond, situated near Readsboro, Vt., into electrical energy and transmitting it to North Adams and other towns in the vicinity. There was a large attendance at the meeting and considerable interest was manifested in the proposed plan. Mr. Kelly discussed his proposed plan at some length, exhibiting a map showing the pond, watershed, pipe line to the power station and proposed wires to the city. The distance from the power station to North Adams is 12 miles, and he proposes to secure from the pond 1,000 horse power, furnishing power 24 hours a day, 308 days in a year.

At the office of the People's Power company in Rock Island, Ill., on January 10th, the contract for an important extension of the company's capacity for generating electric power by means of water wheels at the dam opposite Rock Island arsenal was awarded to the Trump Manufacturing company of Springfield, Ohio. The increase expected to be made is equivalent to 2,000 horse power at seven foot head of water, and the cost of installing the twelve new water wheels called for by the specifications, together with the necessary transmitting machinery, is $23,000. All the power gained by this additional machinery will be used for moving the cars of the Moline Central Street Railway company, which is said to be the largest street railway in the country operated by water power.

Senator Cannon of Ogden, Utah, makes public the announcement that the final arrangements have been completed in the East whereby the Pioneer Electric Power company will be able to sell bonds to the amount of $1,500,000, to complete the work of utilizing the power in Ogden river cañon. The present company was organized in the fall of 1893 and has been prosecuting the work steadily ever since, but has been hampered by the unwillingness of eastern capitalists to invest money in enterprises in a territory. The admission of Utah as a state and the friendliness of the state constitution to outside investors have aided materially in the success of the Pioneer company in floating its bonds. The pipe line, power house and machinery for the development of 5,000 horse power must be completed by September 1st of this year and the other 5,000 soon after. The contract for laying the steel and wooden pipe, which is 30,000 feet in length, has already been let, and the work of laying will be begun soon, as there are now two miles of the trench completed. The wooden pipe, six feet in diameter in the clear, will be constructed on the ground and laid as fast as it can be put together, part of the material having already arrived. Bids are about to be called for for the construction of a large reservoir dam in the valley above the cañon as a preliminary to the development of the remaining 5,000 horse power.

## MISCELLANEOUS.

The *Toronto Globe* claims to be the first newspaper in America using electricity for power for all purposes.

The *Daily Financial News* of New York, in its monthly report of the fluctuations of quotations on the New York Stock Exchange, shows that the highest and lowest quotations of General Electric stock for December were 31⅜ and 29. For January the variation was not so great, the figures being 31 and 22.

In the suit of the New York Guaranty & Indemnity company against the Louisiana Electric Light company and R. T. McDonald, the latter has filed his answer in the United States Circuit Court. Mr. McDonald admits the execution of the mortgage referred to in the bill of complaint, but denies that the 2,000 shares of stock of the Edison Electric company is subject to the conditions of that mortgage. The defendant further avers that the Louisiana Electric Light company had no power under its charter to guarantee the Edison company's bonds, nor had the Fort Wayne Electric company any right to agree to buy them for the Louisiana Electric Light company. Two-fifths of the plaintiff's claim has been satisfied, if that claim is valid, and if it is valid the defendant is entitled to an equitable accounting before an order shall be made upon him for the transfer of the stock in question.

After the end of the present year no more permits will be granted for overhead wires in St Louis. The ordinance providing for burying the overhead wires, which has been under preparation by the city lighting committee of the Board of Public Improvements for some time, has been adopted. It provides that after January 1, 1900, the city shall have the privilege of cutting down all poles and overhead wires, and also for a penalty against any persons maintaining them.

G. W. Hoffman, an engineer and electrician employed by the Electric Improvement company, San José, Cal., was almost instantly killed at the works recently. It was Hoffman's duty to turn on the circuits every night, and he was engaged in that task when, it is supposed, he placed the back of his right hand on the pole of a switch and received the full effect of 2,500 volts. Johnson, an oiler and a fellow employe, heard a noise which attracted his attention. He went behind the switchboard and found Hoffman in a sitting position. The injured man said: "I am done for, Johnson," and fell over. He was carried out and doctors called, but he could not be revived, and died in five or six minutes. The first and second fingers of his hand were skinned, and near the thumb was a small black spot. On the sole of his left foot, close to the heel, was another black mark about half an inch in length.

The Philadelphia Commercial Museum, a public institution wholly supported and controlled by the city, has a bureau of information that should be of value to American manufacturers seeking foreign trade relations. The object of this bureau is to make a collection of foreign commerce, compile all data relative thereto, and make it available to the American manufacturer and consumer in as concise and definite form as possible. This bureau will advise or advise concerning the commerce of all countries, their customs and commercial relations, their international treaties, their systems of communication and transportation, with special details of freight lists and tariffs, exchanges and currency. It is the purpose of this department to be sufficiently broad in its scope to command the good will and co-operation of all manufacturers, bankers, commission houses, transportation companies and all others interested in the development of our foreign trade. The manufacturer who wishes to introduce his goods into new markets abroad will be shown samples of whatever is now salable in those markets. Full details as to the competition he may have to meet will be furnished him.

## TRADE NEWS.

Richards & Meacham of Chicago have appointed George W. Redfield of Galesburg, Ill., to handle the auto-telephone system in Knox and Rock Island counties. Mr. Redfield is well known in electrical circles in his vicinity and no doubt will make a success of this popular type of telephone. Alex. D. Sill of Elgin, Ill., has likewise been appointed exclusive agent for his locality for the sale of the system. All styles of the auto telephones can be procured from Messrs. Redfield and Sill.

The Correspondence School of Electricity of Scranton, Pa., is experiencing a remarkable growth in popularity with the large army of electrical workers who feel their need of electrical instruction but cannot afford to leave home or lose time from work in order to procure it. If it continues at the present rate it bids fair, ere long, to become the most widely known of any of the correspondence schools. It is true that the Correspondence School of Mechanics had on the 11th instant an enrollment of 3,569 students and the Correspondence School of Mines 2,909, while that of the Correspondence School of Electricity on the same date was only 1,522, but it is recalled that the first of these departments was started over a year and the second over two years before the Correspondence School of Electricity had its first pupil.

A statement from the National Conduit Manufacturing company of New York that it has purchased the entire business interest of the Norwich Cable company of Harrison, N. J., will be a surprise to the electrical trade. This arrangement was completed on the 8th inst., and this concern will take up the business of this company and manufacture various sized Cables and will establish agencies in the leading cities throughout the country. This product needs no introduction, as it has been in successful operation for several years, but has been in need of the push and energy which will be brought to it through the efforts of President E. S. Perot, Vice-president C. Gallagher and James P. McQuaide, secretary and treasurer, of the National Conduit Manufacturing company. Arrangements have been made to add new machinery and increase the production of this company to a large extent at once.

The Warren P. Freeman company of 106 and 108 Liberty street, New York, is now settled in its new quarters and prepared to receive orders for electrical and mechanical engineering in all its departments. It is equipped for the manufacture of special electrical and mechanical apparatus and automatic machinery. Especial attention is given to the various lines of experimental work by those who are about to apply or who have applied for patents upon mechanical apparatus. Estimates will also be furnished for installations of electric light and power plants. Dr. W. P. Freeman of this company has a wide and favorable acquaintance in the electrical field, has spent a large portion of his business career in perfecting special machinery, and therefore his services will be of great value to inventors who desire to have work done in a manner to present before the Patent Office in its most improved condition.

Ed. Wertheim, Chicago, has during the last year assumed considerable prominence in the imported carbon market. The Union Carbon Works, Kronach, Germany, for which Mr. Wertheim is United States agent, was started a few years ago on a very small scale, but its success has been so marked that to-day it makes over 1,000,000 carbons per month and these are shipped all over the world. The business in this country has contributed largely to this success. As an illustration of the extensive business which now stands to the credit of Mr. Wertheim, it may be said that his last shipment amounted to over 16 tons of imported carbons. The duty and freight on these, Mr. Wertheim says, amounted to almost $1,600. Such figures as these in themselves pay a high tribute to the excellence of Mr. Wertheim's goods. He carries this large stock in Chicago and keeps in store such a varied assortment of sizes that it is most reasonable to presume that there is no order for imported carbons that cannot be filled accurately and with the utmost dispatch at 53 South Canal street, where Mr. Wertheim has been located in a handsome store since the first of last May.

## BUSINESS.

The Connecticut Telephone & Electric company of Meriden, Conn., has established a Chicago office at 195 La Salle street.

In relation to the hydraulic and electrical improvements for the Cliff Paper company at Niagara Falls, recently mentioned in this journal, it may be added that Leffel water wheels will be used.

The electric light installation in the handsome building of the Duquesne club, Pittsburg, will be a complete one in every respect. Ball engines, built by the Ball Engine company, Erie, Pa., directly connected to Westinghouse dynamos, furnish the light and power.

A practical and useful little book is that bearing the title "Cutter's Handy Wiring Tables," compiled and published by George Cutter, 851 Rookery, Chicago. Common sense definitions, simple formulæ and everyday tables for wiring are given in form suitable for the pocket. Much valuable information is encompassed in small space, and incidentally the Cutter electric light specialties are mentioned.

The foreign business of the Mica Insulator company has grown largely during the last six months, so that it has increased its facilities for manufacturing the well-known insulation materials, having made additions to the factory in London. European manufacturers of electrical machinery are using micanite largely in the construction of their various designs of apparatus, and the company is to be congratulated upon the success which its insulation has met in foreign countries.

The Electric Appliance company has established quite a reputation for bringing out original advertising novelties. Its latest scheme in this line is certainly a good one and consists of a complimentary duplicate order book. The book consists of 50 original and duplicate order sheets bound in a special cover in such a manner that the customer has an impression copy of each written order, made at one writing. The books are furnished complete with carbon paper ready for use, and will be sent on application.

The Knowles Steam Pump Works of 93 Liberty street, New York, have issued a special catalogue of electric power pumps. The company says of this catalogue that it "is compiled, not from designs and data of types as yet largely on the draughting board, and with the hope of influencing business by sheer force of novelty and ingenuity, but from knowledge of machines already built in our own shops, and thoroughly proven in actual service by customers throughout the world." The Chicago office is at 163 South Canal street.

The United States Treasury Department, through the office of the supervising architect, is inviting proposals until March 11th for all the labor and materials required for furnishing and erecting complete one electric passenger elevator, including electric elevator, car guide, wire spring work, Bostwick folding beds, etc., for the United States custom house and postoffice building at New Haven, Conn. Prospective bidders may obtain additional particulars by addressing the Hon. William Martin Aiken, supervising architect, Treasury Department, Washington, D. C.

F. B. Macomber, manager, and George S. Whyte announce that they have charge in this territory of A. Leschen & Sons Rope company. This company's office and warehouse is centrally located at 19 and 21 South Canal street, near Washington street, Chicago, where they will carry a complete stock of wire rope, cordage, blocks, iron, steel and copper wire, bare and insulated, for telegraph, telephone, other electrical and manufacturing purposes, electric railway and light specialities, flat tempered and coil springs of every description, etc. Mr. Macomber and Mr. Whyte will undoubtedly make a success of this business, as both gentlemen are known to be experienced, energetic and aggressive in their respective lines.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued February 11, 1896.*

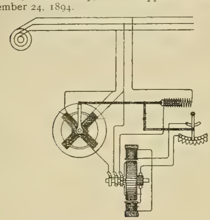
554,230. Regulating Phase Relation of Alternating Currents. Ernst J. Berg, Schenectady, N. Y. Application filed October 8, 1895.

The principal claim is for an alternating generator, lines extending therefrom, between which electromotive forces are to be maintained, electro-magnetic devices responsive to a change in phase relation of current and electromotive force in the lines, and acting in opposition to each other, such opposition being balanced when the current and electromotive force are in phase, and means actuated by the electro-magnetic devices for restoring the phase relation.

554,239. Method of Transferring Feeders. James Burke, Schenectady, N. Y. Application filed December 24, 1894.

The method of transferring a generator from one circuit to another of different potential consists in connecting it to the new circuit through a source of electromotive force while maintaining its connection with the old circuit also through a source of electromotive force, and varying the relative values of such electromotive forces until the potential of the new circuit is reached, or substantially reached, and then completing the transfer

554,240. Method of Electrical Distribution. James Burke, Schenectady, N. Y. Application filed December 24, 1894.



NO. 554,230.

Included in this arrangement are two or more circuits or portions of a distribution system, with generators maintaining different potentials in such circuits, a number of dynamo machines running in unison and coupled in series between the different potential circuits, and a source of current supply connected at a point between the armatures of the machines, and adapted to feed current to the first named circuits at their respective potentials.

554,245. Means for Supporting and Moving Electric Lamps. James Dempsey, Berlin, Conn. Application filed April 1, 1895.

A lamp supporting and moving mechanism is described, consisting of a driving shaft, a fast drum mounted to rotate with the shaft, a loose drum, a ratchet wheel rigidly connected with the loose drum, a rigidly connected projecting sleeve end outside of the ratchet wheel and mounted to have the shaft freely rotate therein, a driving crank on the shaft and a clutch mounted on the projecting sleeve end for locking the loose drum and crank together against independent movement in either direction, and for disconnecting them when desired.

554,247. Battery. Walter S. Doe, Brooklyn, N. Y. Application filed September 18, 1894.

In a battery cell containing a depolarizing liquid, the vessel is formed of the porous cup, and a bottle-shaped top portion sealed thereon, and having an opening in its top or shouldered portion, and a mouth provided with a closing cap, the carbon contained in such vessel, and a rod which is connected with the carbon and extends vertically through and is sealed in the opening.

554,263. Electric Cable. Theodore Guilleaume, Mülheim-on-Rhine, Germany. Application filed March 19, 1895

This cable comprises a main conductor and a safety conductor, the latter being of such a character as to withstand less tensile strain than the main conductor, so that upon the safety conductor breaking, the current is, by means of suitable switch apparatus, diverted from the main conductor before the latter breaks

554,270 Three-wire Electric System. Edward M. Hewlett and William B Potter, Schenectady, N. Y. Application filed September 10, 1895

The method described of changing a compound wound generator from the positive to the negative side of a three-wire system, or vice versa consists in interrupting the main circuit, "flashing" the fields from the side of the system on which the machine is to be thrown, closing the shunt field upon its own armature and finally closing the main switch of the generator, thus completing the circuit.

554,275. Method of and Means for Detecting Grounds. John F. Kelly, Pittsfield, Mass. Application filed June 17, 1895

The method consists in maintaining a conducting needle at zero potential, and subjecting separate parts of such needle to the influence of two fields, each maintained at the potential of one of the respective branches of the circuit.

554,276. Controller for Dynamo-electric Machines. Walter H. Knight, Lynn, Mass., and John W. Darley, Jr., Baltimore, Md. •Application filed May [illegible] 1893

In a series-parallel controller the combination is claimed with a switch for changing the groupings of two or more dynamo-electric machines, of [illegible] provided with a set of contacts and a contact plate thereto movable at a definite different [illegible] relatively to the switch whereby the resistances are [illegible] introduced into and withdrawn from the circuit at periods corresponding to the successive changes in grouping of the machines effected by the switch

554,307 Controller for Electric Motors William B Potter, Schenectady, N Y Application filed August 5, 1895

A series-parallel controlling switch is employed, having suitable circuits and contacts adapted to regulate the motors from rest to a certain speed, and an auxiliary switch adapted to modify the circuits, so that the controlling switch may regulate the motors from rest to another or different speed.

554,321. Electrical Measuring Instrument. Elihu Thomson, Swampscott, Mass. Application filed November 12, 1895.

A coil or conductor traversed by the current to be measured is placed in an inclined or angular position with respect to the shaft carrying the indicator, and a second coil is carried on the shaft and at an angle thereto, and connected in shunt to the first coil, with means for bringing the indicator to zero when no current passes.

554,332. Insulating Joint. George J. Carson, Chicago, Ill. Application filed September 23, 1895.

The combination is claimed with a uniting collar on the ends of two pieces to be joined together, a main locking collar engaging the collar on one of the pieces, and formed with an opening or chamber provided with an annular rim having teeth or corrugations, and an interior locking piece having an annular flange provided with teeth or corrugations to correspond with and engage those of the locking collar, and adapted to be secured to the other piece to be united.

554,350. Trolley and Switch for Electric Railways. Lorenzo L. Stimpson, Boston, Mass. Application filed May 2, 1890.

A car, a trolley pole mounted thereon, capable of expanding lengthwise by suitable moving parts and actuating springs, a trolley wheel mounted thereon, and tow lines extending from the top of the pole to the ends of the car, sustaining it approximately in a vertical position.

554,353. Electric Locomotive. Charles F. Uebelacker, Cleveland, Ohio. Application filed September 6, 1893

Here is the claim allowed: In an electric locomotive the combination with a truck frame and axle, of a transverse bar extending over the axle, springs between the ends of said transverse bar and the truck frame, a U-shaped frame mounted at one end on the axle, said frame comprising parallel arms and a connecting bar, the latter being disposed parallel with and in close proximity to the axle, a spring disposed between said last-mentioned bar and the transverse bar on the truck frame, and an electric motor mounted in the free end of the U-shaped frame, said motor being secured to the transverse bar on the truck frame, a gear wheel on the axle, a pinion on the armature shaft of the motor, and a casing for said gearing carried by the U-shaped frame.

554,365. Electric Motor. John H. Guest, Boston, Mass. Application filed December 23, 1893.

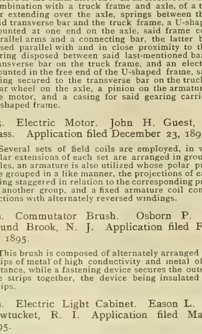
Several sets of field coils are employed, in which the polar extensions of each set are arranged in groups of like poles, an armature is also utilized whose polar projections are grouped in a like manner, the projections of each group being staggered in relation to the corresponding projections in another group, and a fixed armature coil consisting of sections with alternately reversed windings.

554,369. Commutator Brush. Osborn P. Loomis, Bound Brook, N. J. Application filed February 13, 1895.

This brush is composed of alternately arranged layers or strips of metal of high conductivity and metal of high resistance, while a fastening device secures the outer ends of the strips together, the device being insulated from the strips.

554,379. Electric Light Cabinet. Eason L. Slocum, Pawtucket, R. I. Application filed March 21, 1895.

This includes an electric lamp and the connecting wire, with the galvanic battery provided at the bottom of the jar with a well for quicksilver, the positive electrode extending downward into the well, the negative electrode provided with the flange, the packing ring between the flange of the negative electrode and the top of the jar, the box for holding the battery, the cover adapted when closed to seal the jars of the battery against leakage, and a drawer adapted to receive the lamp and its conducting wire.



554,270.

554,394. Insulating Joint. Louis McCarthy, Boston, Mass. Application filed October 14, 1895.

The process of manufacturing insulating joints and the like consists in applying during the assembling of the parts a suitable quantity of dry powered insulating substance or compound at the places where air spaces are likely to be formed in the completed article, and subsequently rendering such substance or compound plastic and solid by the application of heat.

554,395. Telegraph Receiver. Louis E. Oehring, Chicago, Ill Application filed July 20, 1893.

This is a combination with an electro-magnet and an armature lever, of a punch positively moved by the armature lever to perforate the tape, and a releasing dog for permitting the return of the punch independently of the movement of the armature lever.

554,399. Apparatus for Telephone Switchboards Charles E. Scribner, Chicago, Ill. Application filed July 2, 1895.

A telephone line, a line spring-jack upon each of several sections of a multiple switchboard, and an answering spring-jack at one of the sections having contacts adapted to be separated when a plug is inserted into the spring-jack, and arranged to cut off the conductor extending to the line spring-jacks

554,414. Automatic Current Regulator. Stanley C. C. Currie, New York, N. Y. Application filed May 23, 1895.

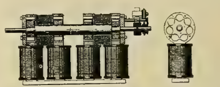
The combination with an electric circuit is claimed, of a source of electric energy, a control magnet, a variable resistance, an expansible apparatus operated by heat controlling the resistance, and a second control magnet breaking the direct circuit from the magnet to line when the resistance has been increased to a determined amount.

554,427. Voltaic Battery. Stanley R. V. Robinson, Brooklyn, N. Y. Application filed May 9, 1894.

The device is composed of an exterior box or cell, a porous cup supported on the bottom of the box, a carbon plate in the cup, a zinc plate outside of the cup, a bracket attached to one side of the exterior box and located at a short distance above the bottom of the box, the bracket constantly supporting the zinc plate by its lower end, an exciting solution in the cup and box respectively, and a rubber lined cover fitting tightly onto the box and cup.

554,445. Slot Iron for Street Railway Conduits. William H. Holden, Chicago, Ill. Application filed July 27, 1895.

A feature of construction in a cable or electric railway is the fixed supports on opposite sides of the conduit, slot irons hinged and adapted to tilt on such supports to open the slot, in combination with a pilot shoe carried by the car protruding into the conduit and located in advance of the power arm, such shoe being tapered, widening horizontally from the front end rearward, and sloping upward from front toward the rear, whereby it is adapted to engage under the slot irons at their proximate edges and tilt them upward apart as the car advances.



NO. 554,365.

554,450. Underground Conduit for Electric Railways. William S. Merkle, St. Louis, Mo. Application filed March 29, 1894.

The claim: In an underground electric system the combination of a plurality of hangers, a conductor semi-circular in cross-section, the flat face of which forms a contact surface, a cap-plate semi-circular in cross-section and provided with perforated side flanges and fixed to but insulated from said conductor, said hangers supporting said cap-plate, flexible insulating material having its edges bolted to the said flanges of said cap-plate, and a flat contact wire extending parallel to the said conductor and supported by the said flexible insulating material.

554,459. Electric Lamp Holder for Bicycles. Edward D. Rockwell, Bristol, Conn. Application filed May 10, 1895.

A reflector is employed, adapted to receive an incandescent electric lamp and provided with a foot, a clip adapted to be applied to a bicycle, a horizontally arranged coupling ring adapted to receive the foot which is removably connected with it, and constructed with an off-setting coupling member forming a center upon which the ring is revoluble in a horizontal plane, and means for connecting the coupling ring through its coupling member to the clip.

554,505. Electrical Burglar Alarm. Clyde Coleman, Chicago, Ill. Application filed November 20, 1895.

Claim one follows: In a burglar alarm, the combination with a signaling device and a meter adapted to control it, of an electrical circuit including said meter and extending from the office to the guarded structure, and permutating rheostats arranged in said circuit and located at distant points.

554,508. Automatic Cut-out for Electrical Converters. William J. Greene, Cedar Rapids, Iowa. Application filed September 30, 1895.

The features claimed include a pair of cylindrical switch closers having a chain belt connection, a pair of opposing terminals, and a contact plate attached to the chain belt, and moving between the terminals, whereby the terminals act as a guide for the contact plate.

554,542. Electric Arc Lamp. John A. Seaverns, Boston, Mass. Application filed March 14, 1895.

Two carbon holders, a time-piece adjusted to a predetermined rate of speed, and a balance wheel in the clock provided with a boss, a series coil, and a controller governed by the current through the coil, whereby the controller is caused to accelerate or retard the movements of the balance wheel, are the features described.

554,557. Electric Switch. Henry B. Whitehead, Memphis, Tenn. Application filed August 29, 1894.

Among the claims is that for the combination with contacts and a spring-pressed switch lever, of a bar mounted to slide on the lever and having a nib projecting over the end of the lever, and also having a nib at its opposite end to be engaged by a key, and a detent for engaging the bar.

554,594. Electric Type Writing Machine. John L. Garber, Sidney, Ohio. Application filed February 26, 1892.

The combination, with the machine, the carriage thereon, the platen, and the cog-roller journaled in the carriage and geared to the platen, of ratchet wheels pivoted on the machine frame and geared to the cog-roller, a vertically swinging lever pivoted on the machine frame and connected by a pawl with the ratchet-wheels, electromagnets for effecting the movement of the lever, and means for closing the magnet circuits by the movement of the carriage.

554,617. Armature for Induction Motors. Abe L. Cushman, Concord, N. H Application filed March 30, 1895

Features of this invention are a coil composed of an active high resistance portion, and two or more low-resistance portions, the high resistance portion and one of the low-resistance portions being constantly in series, and means for cutting out the high resistance.

554,632. Electric Heater or Rheostat Frank Kraemer and Max Krüger, Chicago, Ill. Application filed January 7, 1895

The device consists of a prepared carbon resistance stick hermetically embedded in a plastic body composed of one part of cement, two parts of sand and one part of water.

# Western Electrician.

**EVERY SATURDAY.**

Vol. XVIII. CHICAGO, FEBRUARY 29, 1896. No. 9


## Lighting Plant in the Chicago Y. W. C. A. Building.

It is not without reason that the ladies of the Young Women's Christian association of Chicago take great pride in their fine new building at 288 Michigan avenue. It is a handsome seven-story steel-frame fireproof building valued, with the site, at over $200,000. The principal object of the association is to provide a home for working girls who come to the city as strangers without the protection and guidance of parental influence. Much good has been accomplished in the furtherance of this worthy object, and with the large new building greater opportunity is afforded of contributing to the spiritual, mental and physical well-being of working girls. The edifice, which was formally opened last week, is exceeded by none of its kind anywhere in size and appointments. The enterprise is also noteworthy as a distinctive work for women by women; in all its aspects, financial and otherwise, it is a feminine undertaking, from start to finish. Mrs. Leander Stone is the president of the association, and her executive ability has been shown in the success of the building project.

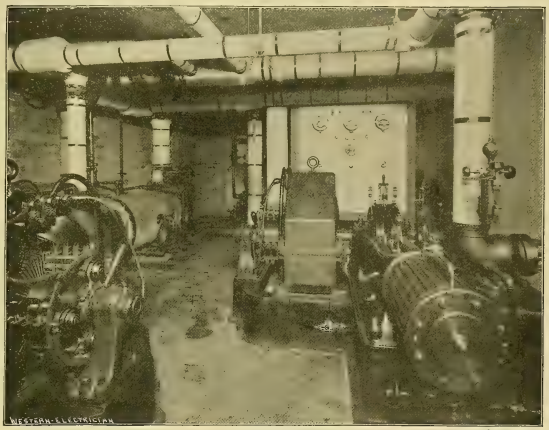
The building is in every way attractive. It commands a fine view of the lake and contains fully 300 rooms. The architecture is of a classic design, and the building throughout is finished and furnished in modern style. The basement is devoted to the employment bureau, class rooms, gymnasium and the mechanical and electrical plant. The first floor has beautifully furnished parlors and reception rooms, a library with bookcases already well filled, a commodious dining-room, and offices. The second floor has a large assembly room with a capacity of seating 600 persons and many bedrooms. The remaining floors are given to dormitories.

Electric lighting for this building is provided by the basement plant illustrated by the accompanying picture. The installation is compact, well arranged, direct-connected and modern in all respects. There are two engine-dynamo units, either one capable of taking care of the ordinary load of the building, so that ample reserve is provided. The engine and dynamo of each unit are placed on a common sub-base of cast-iron, and lead-covered cables, laid beneath the floor-level, lead to the switchboard. Simple Ball engines, supplied with steam from two 80 horse power tubular boilers from Wilder, Keating & Co. of Chicago, drive the dynamos. These engines have cylinder dimensions of 11 by 10 inches and operate at 300 revolutions per minute. The dynamos are four-pole 120 volt machines made by the Western Electric company. They are compound wound and are sparkless with fixed carbon brushes from no load to 40 per cent. overload. Each has a capacity of 40 kilowatts.

White Italian marble panels, red Tennessee marble border, highly polished copper switches and circular Weston instruments make the switchboard pleasing in appearance, although simple in construction and connections. The back of the board is boarded in, and from it the distributing mains lead to the upper floors. All the wiring is in iron armored conduit, and the plant has capacity for supplying current to about 1,400 incandescent lamps of 16 candle power each. No arc lamps or motors are used.

Exhaust steam from the boilers is used for heating the building, and power is also supplied for two Crane steam elevators.

The specifications for this typical modern plant were prepared by Chas. G. Armstrong; the engines and dynamos were installed by A. McEwen for the Western Electric company, the contract being secured by E. W. Goldschmidt; the wiring was performed by the E. S. Karoly Electric Construction company.




LIGHTING PLANT IN THE CHICAGO Y. W. C. A. BUILDING.

## Curious Accident at Butte.

The electric street railway company in Butte, Mont., has recently equipped its line to carry ore, and after having made tests with empty cars, started to load two cars and test again. There is a cut at the loading place, which is too narrow for the cars, and the car got wedged by the projecting sideboards. When the start was made it took all the power to get loose, and being at the top of a grade a mile and a half long, the car gathered speed very rapidly. The brakes refused to work, and the two loaded cars dashed down the grade at terrific speed. There were three men on the train, one of whom jumped. A short distance down the hill a passenger car was met going the other way, but the motorman was alert, and the car was started the other way in time to avoid a head-end collision. The ore train overtook the passenger car soon, but the passengers of the latter had, all but one, time to get out. The shock crushed one man's leg, making amputation necessary, and hurt another. The damage to property was $2,000.

## Texas Street Railway Association.

The Texas Street Railway association will hold its second annual convention at Galveston on March 18th. The present officers of the organization are President W. H. Sinclair, Galveston, and Secretary C. L. Wakefield, Dallas. These gentlemen, with W. H. Weiss of San Antonio, George B. Hendricks of Fort Worth and C. A. McKinney of Houston, comprise the directory. It is announced that at the forthcoming convention supply men will be welcome, and space will be provided for them for exhibits if they desire it. Applications for space should be made to J. K. Urie of the Galveston City Railroad company.

## Conference Upon Wiring Rules.

Preliminary arrangements have been completed for the conference upon wiring rules at New York March 18th under the auspices of the National Electric Light association. In addition to the committee of that organization upon standard rules for electrical construction and operation, composed of W. J. Hammer, H. J. Smith and E. A. Leslie of New York, and James I. Ayer and William Brophy of Boston, the following named organizations represented by the delegates named, will participate in the conference:

American Institute of Electrical Engineers, Professor Francis B. Crocker, New York.

American Street Railway association, John A. Seely, New York.

National Board of Fire Underwriters, William H. Merrill, Chicago, Ill.

Western Union Telegraph company, A. S. Brown, New York.

Postal Telegraph company, Francis W. Jones, New York.

American Institute of Architects, Alfred Stone, Providence, R. I.

National Association of Fire Engineers, Capt. William Brophy, Boston, Mass.

American Bell Telephone company, C. J. H. Woodbury, Boston, Mass.

General Electric company, Lieut. S. D. Greene, New York.

Westinghouse Electric & Manufacturing company, Charles F. Scott, Pittsburg, Pa.

At the present time there is no standard set of rules recognized as authoritative in all parts of the country by all classes and interests. At the meeting in New York it is proposed that the rules which have been promulgated by the various interests, electrical and insurance, shall be taken up for consideration and thoroughly discussed from the standpoint of the interests represented at that meeting, with a view of forming a new code comprising the best that is in the rules now in vogue, and new matter considered advisable. Delegates may take part in the discussion and vote upon the various matters that come up bearing upon the importance and value of the rules submitted without committing themselves or the interests represented. After a code has been prepared which has met with the approval of the delegates attending the meeting, it shall be submitted by the delegates to the bodies which they represent, with the intention of securing approval and support, but no organization is bound to accept these rules or any part of them. The committee hopes, however, that it will be able to compile such an excellent set of rules that its decision shall be unanimously accepted by all interests involved. On behalf of the preliminary committee of the National Electric Light association, which is arranging the details of this meeting, an invitation is extended to anyone to send to the chairman, W. J. Hammer, or to George F. Porter, secretary of the National Electric Light association, 136 Liberty street, New York, any criticism or suggestion upon any of the rules now in vogue or matter which might be included in the proposed new code.

The American Society of Mechanical Engineers has

extended the courtesy of the use of its headquarters at 12 West Thirty-first street for the holding of the proposed joint meeting on March 18th and 19th.

## Electric Power in Chemical Works.

The accompanying illustration, from *La Nature*, is a general view of the works of M. Linet, at Aubervilliers, France. These works produce many forms of chemical products, and especially fertilizers, phosphates, superphosphates, etc.

In an establishment of this nature it is imperative that power should be available in every part of the premises, to the uttermost room, in order to accommodate the grinding, mixing and preparing of the products, at each step of which more or less power is required; and the handling of the manufactured article also calls for motive power.

For several years this house has possessed three steam engines of 150 horse power, with shafting for transmitting this force. But in consequence of extensive additions to the establishment it became necessary to augment the power capacity of the machinery department. Because of the difficulty of satisfactorily distributing steam power and the difficulty of maintaining the moving parts in good condition amid so much flying dust, electricity was substituted for steam.

M. Linet selected for his purpose a gas engine of 80 horse power, here represented on the floor, while below, in the sub-cellar, is shown the transmission installations. The upper room is in the form of a semi-ellipse; the peculiar combinations and arrangements were rendered necessary by scarcity of room. Motion is communicated from the gas engine to the main shaft by means of a belt running over a pulley, from which it may be thrown on to an idle pulley when necessary. From the main shaft a second belt drives the dynamo, in the rear of the engine in the same room. This dynamo by a special arrangement is capable of being run or not, and at various rates of speed as well, as required, consuming only the actual amount of power necessary for the purpose. A traveling bridge crane is seen over the engine.

The present installation comprises only a single gas engine of 80 horse power, but will, when complete, include two other similar machines.

The two dynamos are of the Gramme six-pole variety, making 360 revolutions per minute. One of them, shunt wound, serves the triple purpose of distributing power, furnishing light and of charging storage batteries, and has a capacity of 56.5 kilowatts, 390 amperes at 145 volts. The other dynamo has a capacity of 56 kilowatts, but is wound for 450 amperes at 125 volts. Both arc and incandescent lamps are used in illuminating the works. Motors distributed throughout the buildings are supplied with current by wires from the switchboard at the left of the cut. There are 12 motors, all running at 120 volts. These are. One of 15 kilowatts driving the machinery of the shop, one of 7.5 kilowatts operating a grinding machine, one of 4.5 kilowatts running a gas furnace, two of 7.5 kilowatts employed on the drier, two of 7.5 and 4.5 kilowatts connected to two ventilators, one of 7.5 kilowatts turning a kneading machine, one of 4.5 kilowatts moving a freight elevator, one of 7.5 kilowatts actuating a sack-filling machine, one of 7.5 kilowatts operating a mixing machine and one of 10.8 kilowatts running a dyeing machine.

All these are bi-polar Grammes, shunt wound, with carbon brushes. Experiments running through several months were made under the most thorough tests to ascertain the effect of the dusts in various portions of the establishment, with perfectly satisfactory results.

The efficiency of the various pieces of the installation was carefully worked out at the factory before acceptance by M. Linet. The dynamo tests were as follows for various conditions of load: At 54 kilowatts, 91 per cent.; at 42 kilowatts, 90 per cent.; at 36 kilowatts, 88 per cent.; at 24 kilowatts, 82 per cent., and at 15.6 kilowatts 77.5 per cent. The efficiency of the motors with full load marked 89 per cent., for motors of 15 kilowatts with 900 revolutions, 88 per cent., for 7.5 kilowatts at 1,050 revolutions, and 86 per cent. for those of 4.5 kilowatts at 1,672 revolutions. Tests of the engine were equally favorable. The coal per horse power indicated is 0.508 kilogramme, and 0.691 kilogramme per horse power at the brake.

The fifth annual ball of Illinois, No 40, branch of National Association Stationary Engineers was given at Association Hall, 205 East Madison street, Friday evening, February 28th. Committee of arrangements: A. Bement, chairman, J. W. Matthews, J. N. Lawrence, Byron E. Van Auken, Chas. G. Hubbard.

## Continuous Advertising in the Business Paper.

By N. C. Fowler, Jr.

In continuity is strength. In disconnection is failure. The Builder of the Universe did not build something Monday and build nothing Tuesday and rebuild Wednesday and rest Thursday. He built something every day of the week, and only rested when He was through.

The forces of nature are continuous. The fundamental principle of motion is everlasting. The brook which runs on forever is the brook the fish live in. The brook which dries up this month and is a torrent next month is the brook folks try to get rid of. The man who feeds his horse on Monday and gives him nothing to eat on Tuesday has a weak horse on Wednesday and a dead horse on Thursday. The child who goes to school on Monday and skips Tuesday, and attempts to connect the end of Monday's lesson with the beginning of Wednesday's lesson, is handicapped by conditions diametrically opposed to progressive education.

All things being equal, the store which has been the longest time in some one place is the store which does the greatest business. Change of base, and especially change of business base, is only allowable under conditions which make moving essential.

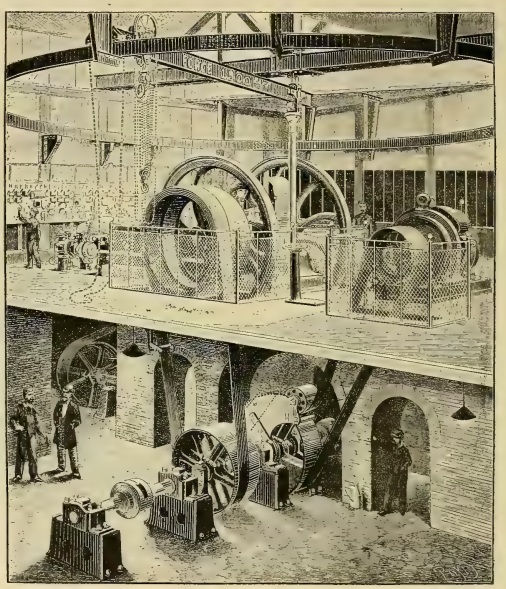
Money is made in specialities and bargains, but the fortunes of trade have been made, and always will be made, along the regular line of regularity; by handling business to-day as it was yesterday, and by handling business to-morrow as it was handled to-day subject to the changes of the times and to the recognition of the conditions of progress. Continuous good is far better and more negotiable than transient good, however good transient good may be.

The most progressive advertisers of the world have advertised continuously. They advertised not for the fun of it. They figure business on the hardest slate with the hardest pencil. All that they do they do for profit only. Ninety-nine per cent. of successful advertisers are continuous advertisers. The man who advertises in January and discontinues his advertising in February must advertise more extensively in March in order to cover the gap his foolishness has created. It takes more advertising in March to bridge the break of February than it does to advertise in January, February and March altogether.

There are lines of goods which can't be advantageously extensively advertised during certain months of the year, but advertising of those goods should never be completely annihilated. It can be reduced in size for any object, but it should be continuous, that there may be no need when extensive advertising again begins of connecting the two advertising periods. The continuity which regulates all good business should be used in the regulation of advertisng.

Advertising is no longer a luxury or a side issue. It is a commodity. It never will be successful unless it is handled the same way as are handled other commodities.

In the continuity of advertising is the good of it. In the continuity of advertising is the strength of it To break the advertising connection is to break trade connection. Trade connection can be broken, advertising connection can be broken, and the house still remain successful, but the shrewd business man is not satisfied with the minimum of success. He is everlastingly striving for the maximum of success. When he



ELECTRIC POWER IN CHEMICAL WORKS.

cuts expenses he cuts proportionately everywhere. He does not stop advertising.

He advertises a little less, perhaps, but he advertises. He never allows the medium he uses to go to press without the mention of his name and of his business. He advertises in off-season in order that the people may be better prepared to appreciate his efforts in season. He keeps everlastingly at advertising and wins.

## Chicago Electrical Association.

The Chicago Electrical association will hold the first meeting of the spring series on March 6th, when a paper by S. G. McMeen will be presented on "Twenty Years' Progress in Telephony." On March 20th "The Gas Engine and its Electrical Applications" will be considered, Charles McDonald contributing a paper on the subject Arrangements have also been made for the following papers. "The Commercial Testing of Iron and Steel," by W. K. Howe, April 3d; "Little Economies in Central Station Practice," by Thomas G. Grier, April 17th; "Problems in Electric Elevator Work," by H. Cochrane, May 1st; "Electric Heating," by Edward Pachta, May 15th. The last meeting of the season will be held May 20th, when the members will enjoy a banquet and devote the evening to social enjoyment

## Electrodynamic Rotations Produced by Means of Alternate Currents.[1]

By Prof. Galileo Ferraris.

Let $O$ (Fig. 1) be a point in a space in which the magnetic fields produced by two electric currents are superposed. Let the directions $OA$ and $OA'$ of the two magnetic fields be different, say perpendicular to each other. If the lengths $OA$ and $OB$ cut off along the axes, give the intensities of the two fields, the diagonal $OK$ of the parallelogram $OAKB$ gives the intensity and direction of the resultant magnetic field. If the intensities of the magnetic fields vary with the time, the point $K$ moves and describes a line the shape of which is determined by the law governing the variation of $OA$ and $OB$; but at each instant the radius vector $OK$ represents the intensity and direction of the resultant magnetic field at the point $O$. If the two currents are alternating and sinusoidal and of the same period, the intensities $OA$ and $OB$ of the two component fields are also alternating and sinusoidal; if they are represented by $x$ and $y$ respectively, they may be expressed in the terms of time $t$ by the equations

$$x = A \sin \frac{2\pi}{T} t, \qquad y = B \sin \frac{2\pi}{T} (t + \delta)$$

where $A$ and $B$ indicate the maximum values, $T$ the period, and $\frac{\delta}{T}$ the difference of phase between the two currents. Eliminating $t$ between these two equations we obtain a relation between $x$ and $y$ which is the equation to the line described by the point $K$ with respect to $OX$ and $OY$ taken as co-ordinate axes.

When the difference of phase between the two current is zero, or corresponds to one entire number of half-periods, the path described by $K$ is a straight line passing through $O$, and on this line the point $K$ traverses distances proportional to those traversed in the same time by $A$ and $B$ on $OX$ and $OY$. In this case the resultant magnetic field has a constant direction and an intensity varying according to the sinusoidal law, like the component magnetic fields. In every other case—*i. e.*, when the two currents are not reversed at the same instant—the path described by $K$ is an ellipse, with its

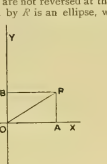



FIG. 1 ELECTRODYNAMIC ROTATIONS PRODUCED BY MEANS OF ALTERNATE CURRENTS.

center at $O$. In this case the vector $OK$, which represents the intensity and direction of the resultant magnetic field, is constantly different from zero, and rotates in the plane $XOY$ about the point $O$; in other words, we have a magnetic field which never becomes zero, and rotates about $O$. The rotating field goes once around during the time $T$, the period of each current. The direction of rotation is inverted if the phase of one of the currents is made different by half a period or an integral number of half-periods.

If, in particular, the directions $OX$ and $OY$ of the component magnetic fields are perpendicular to each other, if the maximum intensities $A$ and $B$ are equal, and if the difference of phase is $\frac{1}{4}$, we have

$$x = A \sin \frac{2\pi}{T} t, \qquad y = A \cos \frac{2\pi}{T} t,$$

hence $OK = A$, and angle $AOK = \frac{2\pi}{T} t$.

The path of $K$ is therefore the circumference of a circle of radius $A$, and the point $K$ traverses it with the constant angular velocity $\frac{2\pi}{T}$; in other words, we have then a magnetic field of constant intensity rotating about $O$ with uniform velocity.

The effects above described may be produced may by means of a single alternating current. It is, in fact, always possible in various ways to obtain the two currents necessary to produce the component magnetic forces from a single alternating current, and to vary the difference of phase between them within certain limits. One way of doing this is by letting the current pass through the primary coil of a transformer. Then the original current and the induced current are at our disposal. By letting those currents traverse two electro-magnets with their axes along $OX$ and $OY$, they may be used to produce the forces $OA$ and $OB$. In order that they may present the required difference of phase it suffices to insert a suitable resistance in the secondary circuit; the difference of phase thus obtained tends toward a quarter-period as the resistance approaches infinity. But then the secondary current becomes too feeble, and must be corrected by altering the number of turns in the electro-magnets, so that $A = B$, and we have a constant field rotating with uniform velocity.

Another method of obtaining the same result consists in producing the two component fields from the two secondary currents, produced in two transformers, of in two portions of the same transformer traversed by the primary current. Finally, to produce the forces $OA$ and $OB$, two derived currents can be used. If in one of the circuits resistances free from self-induction are introduced, and in the other circuit a coil of small resistance and high self-induction, it may be brought about that while the mean intensities of the two currents are equal, or have a predetermined ratio, the phases of the currents themselves differ considerably.

Hence, by a simple alternating current operating in stationary magnets, it is possible to produce a rotating magnetic field, and all the effects obtainable from a rotating electro magnet

Among other things, the phenomena of induction pro-

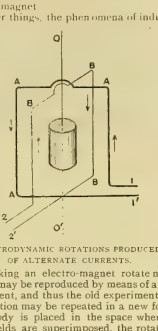



FIG. 2 ELECTRODYNAMIC ROTATIONS PRODUCED BY MEANS OF ALTERNATE CURRENTS.

duced by making an electro-magnet rotate near a conducting body may be reproduced by means of a simple alternating current, and thus the old experiments on magnetism of rotation may be repeated in a new form. If a conducting body is placed in the space where the two alternating fields are superimposed, the rotation of the resultant field produces in a body induced currents, which, by Lenz's law, oppose the rotation of the magnetic field, and upon which the magnetic field reacts with forces which tend to whirl the body around in the same direction. If the conductor is movable, it rotates about $O$, just as if it were placed between the poles of magnets rotating about $O$.

I shall now describe some of the experiments by which I have verified and utilized this fact.[1]

Fig. 2 represents diagrammatically the arrangement adopted in a first experiment. The wires $1\,A\,A\,A\,A'$ and $2\,B\,B\,B\,B'$ represent two flat coils, the former consisting of a few turns of thick wire, and the latter of many turns of a thinner wire. The plains of the two coils are vertical and perpendicular to each other. They intersect along the vertical $O\,O'$, which represents the axis of the apparatus. The coil $A\,A\,A\,A$ of thick wire is introduced in the primary circuit of a Gaulard and Gibbs transformer. $B\,B\,B\,B'$ is inserted in the secondary circuit, together with an adjustable resistance free from self-induction, by means of which the ratio between the intensities of primary and secondary current, and hence also the difference of phase between the two currents, may be varied.

The transformer is arranged for a ratio of transformation equal to unity, but since a great difference of phase must be produced by inserting a high resistance in the secondary circuit, the reduction of the current must be compensated by increasing the number of turns. By suitably arranging the resistance inserted in the secondary circuit the two magnetic fields at the center may be made sensibly equal while having a considerable difference of phase. This condition can be easily realized by

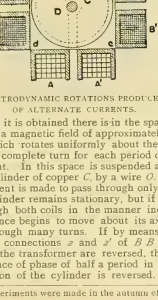



FIG. 3. ELECTRODYNAMIC ROTATIONS PRODUCED BY MEANS OF ALTERNATE CURRENTS.

trial. When it is obtained there is in the space between the two coils a magnetic field of approximately constant intensity, which rotates uniformly about the axis $O\,O'$, and makes a complete turn for each period of the alternating current. In this space is suspended a small hollow closed cylinder of copper $C$, by a wire $O$.

If the current is made to pass through only one of the coils, the cylinder remains stationary, but if the current passes through both coils in the manner indicated, the cylinder at once begins to move about its axis, twisting the fiber through many turns. If by means of a commutator the connections $2$ and $2'$ of $B\,B\,B\,B$ with the terminals of the transformer are reversed, thus producing a difference of phase of half a period in the current $B$, the rotation of the cylinder is reversed. If the reversal of the commutator takes place while the cylinder is moving in a certain direction, the speed decreases rapidly, the cylinder stops, and then commences to spin around in the opposite direction. The same effects are obtained if the two coils $A$ and $B$ are inserted in two derived circuits, one of which contains a resistance free from self-induction while the other has only a slight resistance, but contains a coil with an iron core and considerable self-induction.

The experiments were repeated with the same results, substituting for the copper cylinder an equal cylinder of iron. If the cylinder employed is small, and occupies only a small part of the space between the coils, the experiment succeeds as well with the iron as with the copper. When, on the other hand, cylinders are employed to fill up a great part of the space between the coils, the experiment succeeds less well with the iron than with copper, on account of the high self-induction, of the former. When in fact the coils $A$ and $B$ have a high self-induction, the necessary difference of phase cannot be obtained except by inserting very considerable external resistances, which waste a great part of the available energy.

In one experiment I employed a cylinder of iron, consisting of a number of disks separated and insulated by as many cardboard disks. In such a cylinder the induced currents by which the above result is explained cannot be produced, and yet the result is the same as before. In this case the rotation is due to the lag of the magnetization of the iron disks behind the rotation of the magnetic field to which it is due.

The experiments above described, for the performance of which rough and improvised apparatus suffices, may serve not only as modifications of the classical experiments of Arago, Babbage and Herschel for teaching purposes, but especially for showing the difference of phase between primary and secondary currents in a transformer, or the difference of phase between two derived alternate currents, or that between any two alternate currents of equal period. It is also easy to arrange the experiments in such a manner that they show the variation of the difference of phase as depending upon the variation of the resistances and self-inductions in the circuits.

If now we employ a light cylinder of copper, almost entirely filling up the space between the crossed coils,

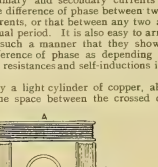



FIG 4. ELECTRODYNAMIC ROTATIONS PRODUCED BY MEANS OF ALTERNATE CURRENTS.

borne by a long bifilar suspension and provided with a mirror for reading with scale and telescope, we obtain a very sensitive instrument, which shows, even with currents of small intensity, very slight differences of phase.

Instead of suspending the movable conducting cylinder by a wire or a bifilar suspension, it may be mounted on a shaft turning in bearings, and by giving it larger dimensions, we obtain an electric motor for alternating currents. It is at once evident, and it also results from considerations which I shall go into later on, that a motor thus constructed would not be of any importance as a means of transforming electrical energy, but by its simplicity and by its properties it is open to some useful applications. I have constructed a provisional model of a motor, and have made some experiments with it.

Fig. 3 is a section of the motor made by a plane perpendicular to the axis of rotation. It may serve to give an idea of the arrangement of the principal parts of the machine. The movable portion of the apparatus consists of a copper cylinder, $C$, mounted on an iron shaft, $O$, and in contact with it. The copper cylinder is hollow and closed by plates of copper at the ends. Its outside diameter is 8.9 cm., and its length 18 cm.; it weighs 4.9 kilogrammes. The shaft $O$ is one cm. in diameter, and is mounted horizontally on two pivots. The fixed portion of the apparatus consists simply of two pairs of coils, shown in section in the figure at $A\,A$, $A'\,A'$, and $B\,B$, $B'\,B'$. One of these pairs of coils, $A\,A$, $A'\,A'$, is arranged with its turns in vertical planes, and when it is traversed by a current it produces in the space containing the copper cylinder a field directed on the whole horizontally. The other pair, $B\,B$, $B'\,B'$, has its turns in horizontal planes, and when traversed by a current it produces in the cylinder space a magnetic field whose mean direction is vertical. The coils are contained in wooden formers of rectangular form. Two of these, those for the coils $B\,B'$, only just allow the cylinder freedom to move. The other two, those containing the coils $A\,A'$, have the same breadth and a greater length, so that they embrace the two formers $B\,B'$ and just fit. When the four are in position they enclose a rectangular space $d\,e\,f\,g$, which is circumscribed about the cylinder $C$, leaving only space enough for freedom of motion. The gap between $A$ and $A'$ and between $B$ and $B'$ is only as wide as the shaft $O$. The coils $A\,A'$ consist of copper wires 1.92 mm. diameter, with 96 turns each. They are joined up in series so as to make a single coil of 192 turns. The total resistance of the two coils is 0.844 ohm. The coils $B\,B'$ consist of copper wire 0.97 mm. in diameter, each containing 504 turns. The two coils are joined in parallel,

1. *Atti di Torino*, vol. xxviii., pp. 360 375. Read March 18, 1888. Translated for the London *Electrician*

1. These experiments were made in the autumn of 1885.

so as to be equivalent to a single coil of 504 turns of double the section. The resistances of the single coils are 7.12 and 6.63 ohms; that of the two coils together is 3.43 ohms.

For driving the small motor I used a Gaulard and Gibbs secondary generator. The thick-wire coils were introduced in the primary, and the thin-wire coils into the secondary circuit. In the same circuit was placed a commercial rheostat free from self-induction, by which the intensity and the phase of the secondary current could be regulated. The resistance corresponding to the best running of the little motor was determined by trial. This resistance naturally depended upon the self-induction of the transformer, and upon the periodicity of the current employed. In my experiments the coils of the transformer were equal, and hence the self-induction of the secondary was equal to the mutual induction of both coils. The frequency of alternation was about 80 per second, and it follows from previous experiments upon the transformer that the apparent resistance due to the self-induction of the secondary coil was about eight ohms. Under these conditions the experiment showed that the best running of the small motor took place when the resistance of the rheostat in the secondary circuit was 15 to 18 ohms. With the above numerical data it may be calculated that the resistance necessary to make the mean intensity of the magnetic field produced by the coils $B\ B'$ equal to that produced by the coils $A\ A'$ is comprised between those limits. It may also be shown that with the above resistances inserted in the secondary circuit, the difference of phase between the primary and secondary circuits must correspond to little under a fifth of a period.

Under these circumstances the copper cylinder of the motor commenced to put itself into motion when the current in the primary circuit reached a value of about five amperes. With a greater current the cylinder acquired a velocity sometimes exceeding 900 revolutions per minute. Beyond this limit the imperfect centering of the cylinder on its shaft gave rise to vibration too violent to allow of the continuance of the experiment.

In the secondary circuit was inserted a commutator by which the connections of $B\ B'$ with the secondary transformer coil could be reversed. The rotation was then also reversed, or, if it was proceeding in one direction, it was gradually stopped and started in the opposite direction. A small dynamometer brake was attached to the shaft in order to give some idea of the order of magnitude of the mechanical work and of its changes. The following table gives the number of revolutions per minute and the corresponding power in watts:

| Revolutions per minute. | Watts. | Revolutions per minute. | Watts. |
|---|---|---|---|
| 262 | 1.42 | 722 | 2.53 |
| 400 | 2.12 | 770 | 2.46 |
| 546 | 2.15 | 772 | 2.04 |
| 655 | 2.77 | 900 | 0.0 |

The mean value of the primary current was about nine amperes, with 80 alternations per second. It will be seen that there is a maximum at about 650 revolutions per minute. On plotting the above figures as a curve, the first portion, up to 500 revolutions, is approximately a straight line. After that the curve bends down. This is due to imperfect centering. Otherwise the curve would reach a maximum at 1,200, and would then descend regularly until at 2,400—*i. e.*, the speed of rotation of the field itself—the available power would reach zero.

The relations between the couple producing the rotations, the useful work, the heat generated, and the velocities of the drum and the field, may better be investigated by assuming ideal conditions, *e. g.*, sinusoidal

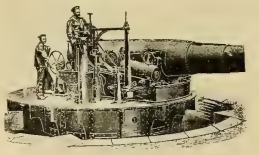


FIG. 2. ELECTRIC TURRETS IN THE DANISH NAVY.—MANIPULATING A TWENTY-FOUR CENTIMETER GUN.

magnetic fields produced by equal currents with a difference of phase of a quarter-period. Under these circumstances the field is invariable and has a uniform angular velocity. Let this be $\Omega$, and that of the drum $\omega$, then their relative velocity will be $\Omega-\omega$. Putting $M$ for the couple exerted by the rotating field upon the currents induced in the drum, $W$ for the mechanical work given out in the unit of time (including that spent on passive resistances), we have

$$W = M\omega, \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Putting $P$ for the energy converted into heat in the unit

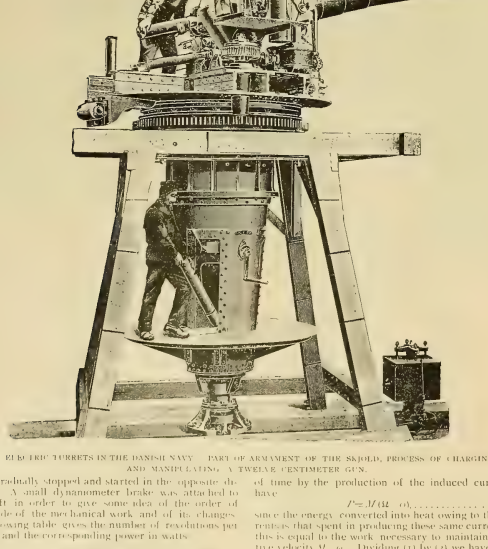


FIG. 1. ELECTRIC TURRETS IN THE DANISH NAVY.—PART OF ARMAMENT OF THE SKJOLD, PROCESS OF CHARGING TOWER AND MANIPULATING A TWELVE CENTIMETER GUN.

of time by the production of the induced currents we have

$$P = M(\Omega - \omega), \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

since the energy converted into heat owing to these currents is that spent in producing these same currents, and this is equal to the work necessary to maintain the relative velocity $\Omega - \omega$. Dividing (1) by (2) we have

$$\frac{W}{P} = \frac{\omega}{\Omega - \omega}, \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

or

$$W = P\frac{\omega}{\Omega - \omega}, \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

*i. e.*, the energy $W$, obtained as mechanical work or kinetic energy, is to the total energy $W+P$, manifested partly as mechanical and partly as thermal energy, as the velocity of the drum to that of the field.

If, as supposed, the magnetic field is constant and rotates uniformly, there is a system of induced currents in the drum which always retains the same configuration. This system rotates about the axis, but the currents shift their places in the drum. The heat developed by the currents in the cylinder is therefore the same as if the currents were constant and stationary. But in each volume element the current is proportional to $\Omega - \omega$, where $\rho$ is the specific resistance of the metal. Hence the heat is proportional to $\rho\left(\frac{\Omega-\omega}{\rho}\right)^2$, or to $\frac{(\Omega-\omega)^2}{\rho}$.

If $k$ is a constant, we can put

$$P = \frac{k}{\rho}(\Omega - \omega)^2.$$

Substituting this in (1) and (2) we get

$$W = \frac{k}{\rho}(\Omega - \omega)\omega, \quad \ldots\ldots\ldots\ldots\ldots (1')$$

and

$$M = \frac{k}{\rho}(\Omega - \omega), \quad \ldots\ldots\ldots\ldots\ldots (2')$$

Given the period of the alternate current employed, $\Omega$ has a definite and constant value. Hence (1′) shows that the energy $W$, manifested as mechanical work, is a maximum when

$$\omega = \frac{\Omega}{2},$$

whereas (2′) gives for $M$ a maximum when

$$\omega = 0.$$

When the mechanical energy $W$ is a maximum, or when

$$\omega = \frac{\Omega}{2}, \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3')$$

gives

$$W = P,$$

so that then the mechanical work is equal to the heat developed.

These calculations and experimental results confirm the evident *à priori* conclusion that an apparatus founded upon this principle cannot be of any commercial importance as a motor, and while we may study its dimensions in order to increase notably its power and output, it would be useless here to enter upon any consideration of this problem. Still, the experiments described may be of some interest.

In the first place, the little apparatus may be useful for purposes of instruction. The couple is always in the same direction, and by the sole power of electro-dynamic forces, always feeble, great quantities of kinetic energy may be developed. In the second place, and this is more important, an apparatus like that just described may serve for measuring the electricity supplied by alternating currents. For this it would be sufficient to brake the movement of the drum by a resistance proportional to the square of the velocity. Since the moment of the moving couple is proportional to the square of the mean value of the current, the velocity of rotation would be proportional to the mean value. Thus the electricity supplied might be measured by registering the number of revolutions of the drum. The axis of the instrument should then be placed vertical, to diminish passive resistance and reduce faults of centering.

I have sought to repeat the experiments with an iron drum of nearly equal weight, but only a very slight rotation was obtained, owing to the high self-induction thus acquired by the coils $B\ B'$. An iron cylinder consisting of insulated disks as before also gave negative results. I also experimented with another kind of motor, where the drum rotated on a vertical axis and occupied the space between the cylindrically bored poles of four electro-magnets facing each other in pairs. One pair was excited by the primary, the other by the secondary current. In this case iron gave better results than copper, but the effects were decidedly less than those before described, and for substantially the same reason as given above. Finally, I substituted a liquid conductor, say a mass of mercury, for the solid drum.

For this the following very simple arrangement was sufficient. The coils $A\ A'$, $A'\ A'$ and $B\ B$, $B'\ B'$ were placed in vertical planes, two and two parallel and perpendicular to the other two, so as to form the four fours of a square prism. In Fig. 4 the four coils are seen in plan. They were joined to each other and to the generator as they were in the motor. $A\ A'$ were put in the primary, and $B'\ B'$ in the secondary circuit, together with the rheostat and the commutator. A beaker $M$, full of mercury, was placed between the coils, and the rotations predicted were observed. Owing to the higher specific resistance of the mercury the speed acquired was much less than that of the copper. The maximum velocity with a current of 10 amperes was about 13 revolutions per minute.

## Electric Turrets in the Danish Navy.

So numerous are the advantages to be gained from the employment of electricity in naval warfare and coast defense that the subject is becoming recognized as one of pressing importance by all governments. In France at this time advantage is being taken of the experience gained in other countries, and the subject is being very generally discussed. *Télégraphie* recently presented an exhaustive article on the subject, in which were quoted the views of Admiral Reveillère, who is most emphatic in his advocacy of electricity as compare

with other forms of power now in use. The opinion of Lieut. Bradley A. Fiske, of the American Navy, was also given considerable prominence, but attention was principally given to the work of the Danish Navy, especially in the matter of the operation of electric turrets.

The Danish vessel Skjold has three of these turrets, Fig. 1. Two are for cannon of 12 centimeters and one of 24 centimeters caliber. If necessary, from any cause, the maneuvering of the guns may be changed from electric to manual by turning a crank, without loss of time. In the largest machine the motor is used for both sighting the gun and for elevating the ammunition from below. The smaller cartridges are raised to the platform by means of an endless chain and by hand carriers. The smaller guns are only sighted by the aid of the motor. The excellent action of these motors was demonstrated in the bay of Havre before a Danish commission and a large assembly of French and foreign officers. Fig. 2 shows the larger pattern.

The handling of the turret is positive and always the same; not only can the movement be stopped instantaneously, but it will obtain a given perpendicular range almost instantly, and accurately within one-quarter of a degree. The parts are so combined that there is perfect equilibrium at all times, so that there is no shock from rapid movements or stops.

The motor which so readily handles this massive turret with its heavy platform, its armor and the 24 centimeter gun with it, is of 15 horse power capacity, but only about 10 horse power is necessary to accomplish the work. The handling of the projectiles of this heavy gun is entrusted to a special eight horse power motor, which also aids by charging the piece. The other smaller pieces are served similarly by three horse power motors.

## Moonlight Schedule.

Following is the WESTERN ELECTRICIAN moonlight schedule for March. It should be borne in mind that this schedule was calculated upon the following basis: Light one-half hour after sunset and one hour before moonset; extinguish one hour after moonrise and one hour before sunrise:

| Day of Month. | Light. | Day of Month. | Extinguish. | Number of Hours. |
|---|---|---|---|---|
| | H. M. | | H. M. | H. M. |
| 1.... | P. M. 6.20 | 1.... | P. M. 9.30 | 3.10 |
| 2.... | " 6.20 | 2.... | " 10.40 | 4.20 |
| 3.... | " 6.20 | 3.... | " 12.00 | 5.40 |
| 4.... | " 6.20 | 5.... | A. M. 1.00 | 6.40 |
| 5.... | 6.20 | 6.... | " 2.20 | 8.00 |
| 6.... | " 6.20 | 7.... | " 3.20 | 9.00 |
| 7.... | " 6.30 | 8.... | " 4.10 | 9.40 |
| 8.... | " 6.30 | 9.... | " 5.00 | 10.30 |
| 9.... | " 6.30 | 10.... | " 5.20 | 10.50 |
| 10.... | " 6.30 | 11.... | " 5.20 | 10.50 |
| 11.... | " 6.30 | 12.... | " 5.20 | 10.50 |
| 12.... | " 6.30 | 13.... | " 5.20 | 10.50 |
| 13.... | " 6.30 | 14.... | " 5.10 | 10.40 |
| 14.... | " 6.30 | 15.... | " 5.10 | 10.40 |
| 15.... | " 6.30 | 16.... | " 5.10 | 10.40 |
| 16.... | " 7.30 | 17.... | " 5.10 | 9.40 |
| 17.... | " 8.30 | 18.... | " 5.10 | 8.40 |
| 18.... | " 9.30 | 19.... | " 5.10 | 7.40 |
| 19.... | " 10.30 | 20.... | " 5.00 | 6.30 |
| 20.... | " 11.30 | 21.... | " 5.00 | 5.30 |
| 22.... | A. M. 12.30 | 22.... | " 5.00 | 4.30 |
| 23.... | " 1.20 | 23.... | " 5.00 | 3.40 |
| 24.... | " 2.10 | 24.... | " 5.00 | 2.50 |
| 25.... | " 2.50 | 25.... | " 5.00 | 2.10 |
| 26.... | " 3.20 | 26.... | " 4.50 | 1.30 |
| 27.... | No light. | 27.... | No light. | 0.00 |
| 28.... | No light. | 28.... | No light. | 0.00 |
| 29.... | No light. | 29.... | No light. | 0.00 |
| 30.... | P. M. 6.50 | 30.... | P. M. 9.30 | 2.40 |
| 31.... | " 6.50 | 31.... | " 10.50 | 4.00 |
| Total ..... | | | | 191.40 |

## A Slight Contrast in the Rates of the Wisconsin Telephone Company.

Citizens of Milwaukee are asking themselves why the Wisconsin Telephone company charges them from $100 to $120 a year for telephones and at the same time makes a rate of $9 to $12 a year for corresponding service in Madison, Wis. They are disposed to question the justice of such an arrangement, but Manager McLeod says it is all right; that the rates in Madison are adopted as a war measure, to strangle competition, and that the exchange there is losing money. In Milwaukee, it will be observed, there is no competition.

The subject is to be investigated by the Common Council. Alderman Rudolph is leading the crusade. He said:

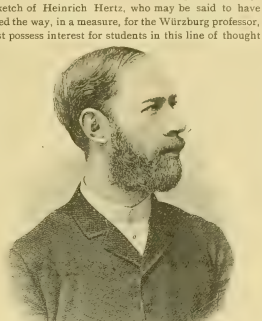
For a number of weeks past I have been gathering information from all the towns of the state in which telephone service is given. I find that Milwaukee is compelled to pay eight or 10 times as much for telephone service as some of these towns. Madison, for instance, is to have the benefit, according to the last circular sent out by the Wisconsin Telephone company, of the very low rates of $12 a year for business houses and $9 a year for residences. I also have information from Fond du Lac, Neenah, Prairie du Chien, Kenosha, Depere, and a lot of other towns showing similar low charges. If the company can furnish service in Madison for $12 a year, why is it necessary for it to charge $100 or $120 in Milwaukee? I purpose to introduce a resolution providing for a complete investigation with a view to compelling a reduction in rates. The council has a right to regulate telephone fees in the city.

Manager McLeod, of the main office in Milwaukee, deprecates such action. He explains that the Madison circular was issued simply as a war measure. The Wisconsin Telephone company has competition in Madison. The rival company announced it would furnish service for $24 and $18 a year. The result of this was the reduction of the Wisconsin company. Mr. McLeod claims the Madison exchange is being operated at a loss. There are several other points in the state where competing lines have been established during the last year, and at all of them rates have been cut, and in some instances telephone service is absolutely free.

This is all perfectly clear, but the Milwaukee people still refuse to accept it as a satisfactory explanation.

## Heinrich Hertz's Work.

At this time, when the whole scientific world is occupied with the consideration of Prof. Röntgen's discovery, a sketch of Heinrich Hertz, who may be said to have paved the way, in a measure, for the Würzburg professor, must possess interest for students in this line of thought



HEINRICH HERTZ.

and experiment. An appreciative biographer in the London *Electrician* (whose initial letters, P. L., indicate that it was none other than his assistant, P. Lenard) speaks of him as "the man with whom science buried its best and richest hopes." While this may be considered extravagant praise for the dead scientist, it must be, and, it may be added, it is, universally admitted that Hertz succeeded in crowding into the 37 years of his life a remarkably great amount of valuable scientific work. It was not alone what he accomplished, but the influence his work had in directing minds into new channels of thought and new lines of experiment.

Prof. Hertz was born at Hamburg, February 22, 1837, his father, Dr. G. F. Hertz, being at the time one of the city's most distinguished citizens. At an early age the subject of this sketch displayed special aptitude for mechanical studies, and when he had completed his studies at the Hamburg Gymnasium he devoted himself to the study of engineering and was engaged in the municipal office at Frankfort during the construction of the great bridge over the Main. He spent a short time at the Polytechnic at Dresden and in the autumn of 1877 he went to Munich, intending to continue his studies at the Polytechnicum of that city, but, as he read over the syllabus of the classes and realized, more clearly than before, the nature of the work that was to occupy him, he began to feel dissatisfied and he finally resolved to go over to the university. After studying for a year at the University of Munich he went to Berlin, and became the pupil of von Helmholtz and Kirchhoff. It was von Helmholtz in particular who exercised the greatest influence upon the whole course of his thoughts and views. Hertz therefore retained throughout his life an especial attachment for him, and a characteristic childlike gratitude toward him. After only one year's work in the laboratory of von Helmholtz he completed his first original investigation, in which he seeks to answer the question whether electricity in motion possesses inertia. Tendered with words of rare praise from the lips of von Helmholtz and Kirchhoff, the work gained the gold medal offered by the Philosophical Faculty for the solution of the problem. It happened also about that time that von Helmholtz drew the attention of the 22-year-old student to the prize problem of the Royal Academy of Sciences of Berlin, referring to the proof of Maxwell's theory, and offered him the assistance of the institute in case he decided to carry out the research. Hertz himself tells us in his work "On Electric Waves" that he thought over the subject, and finally gave up the attempt, realizing that the methods then known were inadequate. But he retained in his mind for eight years the deep impression made upon him by this request of von Helmholtz, until the discovery of new methods enabled him to achieve success in his famous electrical researches.

Soon after this first work Hertz obtained the doctorate, with a theoretical dissertation, in which he solved the problem of Foucault currents with a generality including all previous solutions as particular cases. He was appointed assistant to von Helmholtz—a post which he held three years. During this time he produced an excellent series of researches, both experimental and theoretical in character. Their number, 12, testifies to the enormous capacity for work their author possessed, while their contents show how wonderfully he mastered, even at that time, theory as well as experiment. In the year 1883 Hertz left Berlin, and, following the advice of von Helmholtz, settled down as privat-docent at the University of Kiel, where he received a teaching appointment from the Prussian minister. During his stay of two years he was occupied exclusively with theoretical investigations, there being no laboratory at his disposal. But he was always partial to the subject of his first work, electro-magnetics, upon which two very important communications were published by him about this time. At the age of 28 he received almost simultaneously three calls to professorships, in Greifswald, in Kiel itself, and in Carlsruhe, the last of which he accepted, being well pleased with the laboratory.

He observed the small sparks at the ends of a Riess spiral used by him in a lecture, and the very fact which so many had previously passed over became for him the starting point of his great researches. The recognition of such work was not wanting; it is now consoling to know that it came so quickly. Hertz was soon invited to become the successor either of Kirchhoff in Berlin or of Clausius in Bonn. He preferred the latter, and went to the Rhenish town in the spring of 1889. England, also, was not backward in doing honor to his success. The Rumford Medal was awarded to him; the Literary and Philosophical society of Manchester and the Cambridge Philosophical society each elected him as an honorary member and the London Mathematical society conferred the same distinction upon him. The latter especially pleased Hertz, as being a particular recognition of the mathematical merits of his researches. He became a member of almost all the chief continental academies and many prizes were awarded to him.

For three years and a half Hertz thus lived happily in Bonn, perfectly content in his sphere of activity. In the last three years of his life Hertz completed a work on "The Principles of Mechanics."

At the time of the announcement of his results Hertz's experimental work attracted as much attention in the scientific world as Prof. Röntgen's later discoveries, but while the consideration of Hertz's theories occupied the scientific mind, they did not appeal as forcibly and directly to the public generally as do those of Röntgen. "Hertz's Experiments with Waves of Electric Force" was the title of an exhaustive series of papers by Prof. C. S. Cook in the WESTERN ELECTRICIAN in November and December, 1889, and a brief sketch of Prof. Hertz which was published in this journal January 4, 1890, four years before his death, closed with this sentence: "He is a young man, and there are many predictions that he will render to science services which will make his name still more famous." The universal regret expressed at the time of his death is now recalled by the Röntgen discovery.

Many queer minerals are reported to be found in Utah. Among them is a substance known as ozokerite, or mineral wax. George Eldridge of the Geological Survey says: "Sometimes the ozokerite occurs in pockets between layers of shale. It has not been mined at all. Many uses for it are likely to be discovered in the future. To electricians it will be valuable doubtless, inasmuch as it is one of the best insulating materials for employment in their business."

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FOR several years the street railway companies of the state of New York have been organized for mutual protection, one of the chief aims of the association being to prevent hostile legislation. The same interests are now lending their influence to the promotion of a bill providing for the extension of the power of the railroad commission of the state so that that body will have absolute control of the future development of the transportation facilities of the commonwealth. Aside from the recommendation of this position, the policy which the street railroads' operators are now pursuing is fraught with danger. Instead of encouraging legislation of this character these companies should exert their influence to restrain and prevent every movement having a tendency to place in the hands of a commission such unusual powers, and thus indirectly encourage special legislation of this class on the ground that governmental influence is detrimental to their interests and jeopards financial investment. They should take into consideration too the fact that the railroad commission is the most unpopular of the many boards which infest the state government, and an alliance with that body will not raise the street railroad corporations in the estimation of the people from whom they receive valuable franchises and to whom they must look for support.

OUR sympathies are extended to the municipalities and small towns throughout the country, especially in the Northwest, which very foolishly followed the example of Chicago in establishing a municipal lighting plant. These communities are already beginning to realize that they have made grievous mistakes in following Barrett's advice, and they are all trying to get out of the hole into which the professor betrayed them. One of the latest of this class is the city of Chariton, Iowa, which finds its investment in an electric light plant not a paying one. The plant will have an annual deficit of $200 to $300 at the present rate, which is a considerable sum for a small town, and the City Council is casting about for some plan to increase revenues. It is proposed to lease the plant to a private firm. Our Minneapolis correspondent says that something must be done soon or the streets will be dark, as the mayor says he will refuse to sign any more warrants for light after March 1st. Chicago finds that its lighting plant is a good deal of trouble and a very costly experiment.

MOST unenviable and most discreditable was the record established by the transportation companies of Chicago during the month of January, when, according to the police reports, 776 accidents occurred on their lines. This number does not include all the accidents within the city limits, either, as many are never reported to police headquarters. The steam railroads contributed the greater portion of the serious accidents, and a large proportion of those on the street railway lines could be traced directly to the carelessness of the victims. But even after taking these facts into consideration it must be admitted that the number of accidents in the first month of the year was alarmingly large. Something should be done, and it behooves the corporations to take the initiative. Once the people are aroused on this subject, they will insist upon placing restrictions upon the companies that will be hard to bear, if indeed they do not force the offenders out of business by retaliatory measures.

FROM every part of the country come announcements of results obtained in experiments with X-rays, conducted at educational institutions, but the great University of Chicago, from which so much might have been expected with reason, makes no contribution to the general fund of knowledge upon this topic. A published interview with one of the professors contains the information that no experiments have been conducted at that institution, no lectures on the Röntgen discovery have been delivered, nor has any special arrangement been made—in fact, it is admitted that the university has no equipment suitable for such work.

At this time and in this connection it may be well to recall the discussion at the Chicago Electric club four years ago, when Dr. W. R. Harper, president of the University of Chicago, pledged that institution to the establishment of a system of technological education and the equipment of laboratories for experimental work in electrical and mechanical branches. At that time he said: "The work should be done in a manner worthy of Chicago; promptly, in fact, immediately, and upon a large and ever growing scale." What has the great university accomplished for technological education? It seems as if some progress might have been made in the four years that have since elapsed. What explanation has Dr. Harper to offer?

IT may be interesting to those who are considering the advisability of engaging in the manufacture of acetylene to call attention to this statement by one of the most reliable electrical engineers in this country: "Taking the results at Spray as a fair basis, I find that it will cost $60.95 per ton to produce calcium carbide in Chicago, as against $23.41 in Spray; that is, figuring that a horse power in Chicago will cost $45 per year, including all operating expenses and interest on investment of the plant. That is about as low as you can figure it on the conditions we have in Chicago. A pound of carbide equals 5.13 cubic feet of acetylene gas." This assertion by B. J. Arnold at the recent convention of the Northwestern Electrical association at Milwaukee was made in the course of the discussion upon Mr. McMynn's paper, entitled "Some Facts About Acetylene Gas," which we published on February 1st. Other well-known engineers made similar statements about the cost of producing the gas, and Mr. Summers called attention to the fact that acetylene gas "cannot be produced in very small plants, as it requires at least 25 horse power to produce the arc, and a much greater horse power to produce the gas commercially." Mr. Arnold added that "the factory at Spray uses 184 horse power to produce a pound of calcic carbide." There are a good many things about the experiments and the plant at Spray that are not alluded to by the gentlemen who are exploiting "acetylene rights" throughout the country. The new illuminant may have many excellent features to commend it, and if it possesses the merits which its friends claim, it is to be hoped that its commercial introduction will soon be undertaken by others than those at present in control.

VERY often an old story takes on additional importance many years after it was originally told because of its application to some subject of public controversy of later date. This is shown in the litigation now pending involving the validity of patents covering the polyphase system. Eight years ago Prof. Ferraris read a paper before the Turin Academy upon "Electrodynamic Rotations Produced by Means of Alternate Currents," which describes experiments conducted by the author several years before. This paper is relied upon in England and on the European continent as a prior publication of the principles of polyphase induction motors which Tesla claims the destinction of inventing. It is claimed that Tesla's complete English patent specification bears date of May 8, 1888, whereas Prof. Ferraris read his paper in Turin on March 18, 1888; but then again, Tesla's various American patents were dated in 1887 and early in 1888. The article presented elsewhere in this issue is, we believe, the first complete translation of Prof. Ferraris' paper published in this country. Aside from its bearing upon the controversy over the Tesla patents, the paper is an interesting contribution showing the condition of the art when these experiments were conducted. It presents an excellent idea of a rotating magnetic field produced by two sinusoid, alternating currents differing in phase but of the same period; and gives a description of how two currents differing in phase may be derived from a single alternating electromotive force, as well as the mechanical effects producible by such a rotating field. Actual experiments are recorded with several forms of apparatus made in 1885, to demonstrate the theoretical conclusions arrived at, and a motor is described having a short-circuited armature nearly nine centimeters in diameter and 18 centimeters long, which developed a maximum available power of 2.7 watts. It may have been because of this very small output that, after having shown the laws which govern the output and efficiency of such a motor, Prof. Ferraris sought to find the conditions of maximum output, and came to the conclusion that this was reached (neglecting leakage) when the speed of rotation of the armature was half that of the revolving field. "These calculations and experimental results," he says, "confirm the evident *à priori* conclusion, that an apparatus founded on this principle cannot be of any commercial importance as a motor, and while we may study its dimensions in order to increase notably its power and output, it would be useless here to enter upon any consideration of this problem."

This conclusion was reached after Prof. Ferraris became convinced that an efficiency exceeding 50 per cent. could not be obtained. An explanation of his failure to secure better results is suggested by the London *Electrician*, which says: "To anyone reading the paper to-day with present knowledge, the wonder must be that, with so clear an insight as Prof. Ferraris evidently had of the principles of his invention, the forms which he designed were such as to give these small results. But in 1885 the magnetic circuit was hardly understood, and the motor was probably quite as far advanced as the transformer from which it was worked." The same authority says that in this paper the essential principles at least of a two-phase induction motor, and the general theory of its action, are most explicitly given—so explicitly, indeed, that it would seem impossible for any serious claim to be made that this paper was not a complete publication in England of the polyphase induction motor. Particular constructions and particular methods of working may form the subject of subsequent invention—a very different matter to a bread claim such as has been suggested.

It is expected that this paper will assume importance in the litigation pending in this country.

## Experiments with the "X" Rays at Armour Institute Laboratories.

By W. M. Stine.

It was not until the 17th inst. that the writer was enabled to devote serious attention to the experimental investigation of the new radiant. Since then experiments have been prosecuted with all possible diligence, with the able assistance of Professors T. P. Gaylord and J. E. Snow. A summary of our experiments and results may be of interest.

*The Apparatus.*—The induction coil used was made by Carpentier at Paris and is capable of producing sparks six to eight inches in length. The current was furnished by a bank of storage batteries. The pulsations of current were produced at times by the use of a mercury interrupter, and later by a rapid make-and-break vibrator. A cylindrical interrupter resembling a commutator was also employed. This broke the circuit twice in a revoultion, and was driven by a small motor. Two condensers, with a total capacity of 14 microfarads, were connected across the brushes of the interrupter, their large capacity enabling the use of high currents without injurious sparking. From our assortment of Crookes tubes one was selected as most suitable, known as the shadow, or Maltese-cross tube. This tube contains a light aluminum cross which, by the shadow on the bulb, shows that the cathode rays may be interrupted, and that they also pass in straight lines. The cross, being hinged, was tipped over when in use for sciagraphy. The tube is pear-shaped and about 10 inches in length. A cathode disk three-quarters of an inch in diameter is located at the smaller end, and the glass, being purposely rich in uranium, yielded a brilliant greenish-yellow fluorescence under the bombardment of the cathode rays.

It was early found that the disposition of the dry plate was of greatest importance. In preliminary trials the plate was placed in an ordinary holder and covered with the ordinary cardboard slide, coated with a black varnish. This was found to be so opaque that the X-rays did not penetrate it with an exposure of one hour. Later experiments led us to conclude that such cardboard is quite opaque, but the negative results were probably due to the black varnish rather than the slide. A definite method for placing the plate was then adopted. It was wrapped in the black paper which comes around dry plates, and placed in a pasteboard box, with the objects whose shadows were desired laid over it. The lid was closed, and the whole wrapped in several folds of black cloth.

*Experiments.*—The first real trial was quite successful. A pair of pliers was placed over the plate and exposed to the tube for one hour. A dense negative was the result, with the tool in clear shadow. The tool was separated about one inch from the plate, and the negative showed a marked penumbra. A hand was next attempted, and an exposure of 75 minutes produced a satisfactory negative. It occured to us to investigate the influence of the rapidity of the pulsations on the time of exposure To this end the circuit-breaker was run at a slow speed, and the plate given an exposure of 40 minutes. Another trial was made with the highest available speed of the motor, producing about 8,000 interruptions per minute, with the same length of exposure, and a much feebler negative resulted. At this high rate of pulsation, although 12 cells of battery were used, the fluorescence was faint. Concluding the time constant of the coil was too large for such speeds, a moderate number of pulsations per minute was adopted for all future tests.

The sensitiveness of the dry plate next engaged attention. A fresh Seeds 27X plate, suitable for the shortest instantaneous exposures, was placed in a box, and a small Carbutt B16 plate placed on one end of it. The exposure in this case was 45 minutes. The plates developed promptly within three minutes, both coming out with equal speed and density, just as is the case when correct exposures are made with sunlight. Several additional tests were made comparing rapid with slow dry plates. As a result, we were unable to note that the length of exposure was in any way connected with the light sensitiveness of the dry plate used. This will certainly prove a somewhat startling result to photographers, as it runs counter to all practices of their art. This point clearly established, we adopted the slow plate for all future tests. This was done since a slow plate works with greater density and perfectly clear shadows, and is not so liable to suffer chemical fogging under prolonged development. In one experiment, among other objects a brass-bound boxwood foot-rule was placed on the plate, and exposed to the rays for 40 minutes. A perfect negative was the result; the rivets through the wood showed clearly, and even the graduations were seen. We concluded the latter were due to the opacity of the black paint which is used in filling in such markings. On the same plate lay an ivory caliper ruler, and the negative showed the ivory was as opaque as the German silver trimmings. We believe we first noted the extreme opacity of ivory. We were led to conclude that all animal and vegetable structures were transparent, while only mineral and metallic substances were opaque. An approximate test of this was made by exposing a plate under an oak board half an inch thick, and showing the edge of the grain. In the developed plate, the grain was clearly perceptible, due probably to mineral constituents in the plates forming the grain. Such tests may prove valuable in woodworking. A wood screw and several nails had been driven into the wood. These showed very clearly, the threads on the screw being in strong evidence. This may also prove valuable in practice.

It seemed desirable to make a thorough test of a hand. A subject was found with a piece of cartridge shell in the third finger. The hand was firmly bandaged on an 8 by 10 Carbutt plate, and exposed for two hours, but unfortunately, considerable trouble was experienced with the interrupter. Yet on development we found we had obtained one of the clearest negatives of a hand yet described. Scarcely any trace of the flesh remained, even in the palm and wrist, and all the bones of the fingers, palm and wrist were defined with remarkable clearness. At least two equally good negatives are on record, but we believe ours is unique in having been made on a slow plate and with a relatively short exposure. While such experiments are of the greatest value in surgery, they are somewat sensational.

*Nature of the New Radiant.*—We come now to the main object held in view in our tests—the nature of the new radiant. It is a matter of the greatest moment to decide whether these rays are waves of longitudinal or transverse character. A crucial test seems to submit them to some form of polarizing apparatus. Röntgen had already found that Iceland spar was one of the most opaque minerals, so the ordinary Nichol prisms did not seem suitable. Recourse was had to tourmaline plates, of about one-sixteenth inch thickness. These plates are cut from a crystallized mineral whose peculiarity is that transverse vibrations can pass through it only along one line or axis. In this sense they resemble a slotted grating. We first examined the transparency of tourmaline, and found that this thickness was sufficiently transparent. If such plates are superposed so that their axes coincide, they are quite transparent to light rays. If, now, they are turned so that their axes are at right angles, they become almost opaque. In short, a transverse vibration practically cannot pass through them. As an illustration, suppose a piece of rubber tubing is stretched through an ordinary cellar grating. If the tube be snapped, a transverse wave passes over it, and if the plane of these waves is parallel with the grating slots, it readily passes through. Now, suppose further that two such gratings are superposed so their slots are at right angles; it is evident that transverse waves on the rubber tube would be stopped out and unable to pass through them. The tourmaline plates were placed over each other so the axes were in coincidence. An exposure of 45 minutes was given a plate placed under the tourmaline. Development showed the rays had passed through quite freely. The tourmalines were then crossed to opaque position, and another plate exposed under the same conditions and for the same length of time. Development proved the rays had passed through as freely as before. In short, the tourmalines had failed to polarize the rays, so far as we could judge from the negatives, which were sufficiently sharp to afford a critical comparison. It will not do to positively state that this one line of experiment proves conclusively that the X-rays are longiudinal and not transverse. However, it is a strong presumptive proof, when taken in connection with experimental data so far on record. At the present writing, the accumulated evidence in favor of longiudinal ether vibrations seems too strong to be overthrown.

From the first publication of Röntgen's discovery, interest has centered in obtaining other methods than the employment of Crookes tubes for producing the new rays. Metallic plates connected to the terminals of the coil were experimented with, but though some results gave promise of success, nothing of a definite character has been established. A number of investigators have been led into serious error here, and it is questionable if a true sciagraph has yet been made with other than some form of Crookes tubes. It has been known for a long time that if a metallic object be placed over a dry plate and electrified, an image of the object will be found impressed on development. Such a result may be termed an electrograph, and is doubtless caused by the silent brush discharge. But the sciagraph and electrograph must be sharply distinguished. The sciagraph is a shadow of the object showing in the negative as a clear image on a dark background. The electrograph is an impress of the object showing on the negative as a dark image on a clear ground. A critical examination of the reports so far obtained indicates the results have been electrographs pure and simple, and not sciagraphs. However, it is by no means certain that a sciagraph cannot be obtained under such conditions. We intend at once to prosecute further experiments along this line

The incandescent lamp bulb has come in for a large share of attention. We have investigated this form of vacuum tube very thoroughly and speak of our results with considerable assurance. Our method of experiment was to paste an electrode of tin foil on the outside at the largest diameter of the bulb, using the connections to the filament for the other electrode. Out of a large number of lamps so tested, only one gave positive results, a sciagraph of four iron washers which rested on the plate. The exposure was one hour, and a true shadow picture was the result, though this was quite faint. We have noticed quite a difference in the vacuum in lamps, not only by different makers, but of the same brand. It might be said as a general statement that the vacuum in the incandescent lamp is too low; in consequence, it behaves as a Geissler rather than a Crookes tube. These bulbs are blown from lead glass, which at best possesses but a faint blue fluorescence, and since it has been abundantly demonstrated that fluorescence in glass is at least a secondary source of the X-ray, such bulbs must be less effective. We shall experiment further on the efficiency of fluorescence for the production of the X-ray.

For reasons too lengthy to discuss here, it seems likely that a species of electrolysis is associated with the longitudinal vibrations in the production of sciagraphs. If the effects on the dry plate are due to longitudinal vibration merely, there is reason to suspect that any molecules, of carbon, for instance, vibrating with frequencies sufficient to establish light rays in the ether extending well over the spectrum, should, at the same time, be active sources of the X-rays. To this end we have carefully examined the light from the arc lamp, with a clear negative result. At least one experimenter writes to an electrical periodical that he has obtained a sciagraph under these conditions; but his account shows he has confused the sciagraph with a purely chemical fog. This was probably due to the fact that his plate was not sufficiently covered, and leaked light through the cloth wrapping during the long exposure.

While experimenting with external electrodes we noted a curious effect which, so far as I am aware, is not mentioned in the literature of the Crookes tube. The Crookes tube in question contained a whirler to show rotation due to the cathode stream. When the two external electrodes were used only the cathode produced the so-called cathode rays, as noted by the shadows of the vanes on the bulb. With one internal electrode and an external one of tin-foil, the shadow, from the streams given off from the internal electrode, was permanent, whether this was made the cathode or anode.

There is a marked peculiarity noticeable in connection with a Crookes tube strongly excited. It grows very hot opposite the cathode, or when the cathode stream impinges on the walls of the bulb. It is possible, with a sufficiently strong current, to melt the glass. If the hand be held near the heated bulb, decided pulsations are felt, due probably to heat waves or impulses. The question of distance of the dry plate from the bulb may be of interest. Since the fluorescence of the bulb is a secondary source of the X-rays, these spread out rapidly, and though so far it is impossible to focus them, yet the time of exposure varies roughly, as the inverse square of the distance, at least so far as the fluorescent source is involved. A good working distance is three or four inches.

The dealers say that their supply of Crookes tubes has been long exhausted, and that there is an enormous demand for them. To meet this, several glass-blowers in Chicago are attempting their manufacture. We have been experimenting to develop such manufacture, but find the chief drawback is in the vacuum obtained. To produce the most efficient tube, the highest possible vacuum seems necessary. It has just been discovered in England that X-rays discharged an electrified body. This affords a possible explanation for the failure of Geissler tubes. The X-ray is doubtless produced in them, but it is absorbed by the great number of charged

molecules present in the bulb. In the same connection Professor J. J. Thomson asserts that under the influence of the X-ray a non-conductor becomes a true conductor of electricity. However, this is not probable; the energy of the charge under the influence of the X-ray is rather transformed directly into heat energy in the charged body.

Another important item of news comes to us from Europe, that the sciagraphs have been made with a tube containing an aluminum window for the passage of the X-ray, and that such tubes are most efficient. Several American experimenters have failed in doing this, probably because of the low vacuum in their tubes, or lack of familiarity with the phonomena of radiant matter.

One of the strangest peculiarities associated with the X-ray is that we possess no sense organ for detecting its presence. It is this which makes experimentation with the rays so difficult, for they lie so completely beyond our sphere of sensation. What is now greatly needed is some highly sensitive fluorescent compound from which a screen may be prepared to detect the presence of the rays, throughout a great range of wave length.

## Some Cathode Ray Experiments in Massachusetts Colleges.

[From the Boston correspondent of the WESTERN ELECTRICIAN.]

Prof. Röntgen's application of the cathode, or X-ray, has opened up a wide and fascinating field of experiment, which is being explored by students in Boston with zeal and earnestness. At Harvard Prof. Trowbridge is experimenting with it with a view to its application to surgery. At Tufts College Prof. Dolbear and Instructor Chase are beginning a series of researches on different lines from those pursued anywhere else. At the Institute of Technology Dr. Goodwin has shown that the cathode ray will penetrate the human body, wood, vulcanite or brass. At Wellesley all the girls and professors are excited greatly over the discovery, and Prof. Whiting has conducted some very successful experiments. At one of the large Boston hospitals experiments will soon be begun on an extensive scale in order to bring the ray into the service of medical and surgical science. In numerous private laboratories throughout the city and state Röntgen's experiments are being repeated with variations.

At the Institute of Technology in Boston, Dr. Goodwin has arranged a very thorough test of the properties of the cathode ray. By means of a simple electrical apparatus, consisting of an electroscope and a thermopile, he has been able to charge metallic sodium in a vacuum tube with negative electricity. This was then discharged by the cathode ray, which was separated from the tube containing the electric charge by a brass shield one-half inch in thickness. The ray was also made to penetrate the body and clothing of a student, and caused the discharge of the electric charge. The sensitiveness of the test was shown by the fact that the cathode ray discharged the charge of electricity on the sodium, although at a distance of three feet, and with a vulcanite wall one inch thick separating the ray from the vacuum tube containing the sodium. The scientists at the institute are inclined to think that Dr. Goodwin's discovery may lead to further discoveries as to the nature of the ray itself, its wave length, etc. This test appears to put the cathode ray side by side with the ultra-violet rays of the spectrum, which have almost the same effect as the cathode ray on the negative charge of electricity on the metallic sodium. In some cases at the institute the cathode ray has gone completely through one dry plate and ruined a second plate in the back of the holder. Prof. Charles R. Cross has made photographs of the bones in living human hands, and has reproduced distinctly on the photographic plates all deformities of the hand, such as broken knuckles or bones.

The first practical surgical application in Boston of this new means of photography was made a few days ago at the Institute of Technology. The patient was a young woman who was in charge of one of the physicians of the City Hospital. Her wrist, which had been badly fractured, was "shadow-printed," if the term may be allowed, and a very accurate picture of all the broken bones was obtained. All the physicians were greatly interested in the picture, as it served to corroborate the doctor's diagnosis, which had been doubted. As a result of this experiment an extensive apparatus will be placed in the City Hospital, and the test of the applicability of this photography to surgical operations will be made. Prof. Cross is of the opinion that the rays emanating from the cathode of the Crookes tube are not the rays which penetrate aluminum, vulcanite and brass, but are unknown rays which are generated by the contact of the cathode rays with the glass of the tube.

At Tufts College, Medford, Prof. Dolbear has been too busily engaged with other duties to devote much attention to experiments with the cathode ray. He has, however, followed with great interest the work of other investigators, and is reported as saying that he anticipates great results to science from the present researches.

Prof. John Trowbridge, the lecturer on the application of science to the useful arts, at Harvard University, and director of the Jefferson Physical Laboratory, has been experimenting for several years in the direction of the cathode ray. It was about the last of January that he made his first thoroughly successful experiment, and since then he has had but few failures. He has taken many pictures of different objects impervious to ordinary light, among them being one of a number of coins in a purse. One of his most successful pictures is that of a chicken's leg and claw, an almost perfect image being obtained of the bones in both the leg and foot. Another picture is that of a hand, which had been photographed through an inch board with an exposure of only one minute. This is so distinct as to show the outlines of a ring on one of the fingers. "We are now trying," said Prof. Trowbridge to a reporter, "to photograph through thicker substances, to obtain, for example, a clear image of a bone or a solid in the thickest part of a man's body. All that we have been hitherto able to accomplish is to obtain images through a comparatively thin body, because the cathode rays cannot be developed strongly enough at present to do much more than they are now doing. The trouble lies with the Crookes tube, which is not strong enough to resist the great electrical tension necessary to produce the desired results. This is the fault of the material at the entrance of the tube, which is sure to become heated with any very great tension and break the tube. The matter now stands about where the telegraph stood years ago when people declared that all experiments in that line were useless. I hope, however, that the trouble with the Crookes tube will soon be obviated."

In a recent lecture Prof. Trowbridge gave an interesting comparison of the different lengths of time required for photographing by the different processes. In 1827, by heliography, a six-hour exposure was necessary; in 1839, by daguerrotype, 30 minutes; in 1841, by calotype, three minutes; in 1851, by collodion, 10 seconds; in 1864, by collodion, five seconds: in 1878, by gelatine, one second.

## Results Obtained at Fort Wayne.

A press dispatch dated Fort Wayne, Ind., February 16th, says; The first experiments attempted in this city of obtaining prints by the Röntgen process were made last evening in the laboratory of the Fort Wayne Electric corporation, interesting results being obtained. In place of Crookes' tubes, an ordinary incandescent lamp of large size was used. The electrodes consisted of aluminum disks. The sensitized plate was covered with two thick pieces of cardboard, upon which were several coins, the whole being covered with a heavy sheet of black felt. The exposure lasted 40 minutes, and resulted in giving a perfect shadowgraph. The developed negative also disclosed well-defined secondary images on the plate. These secondary images appear to the right of the coins on the right half of the plate, and to the left of those on the left side. Thomas A. Duncan, electrician for the electric corporation, conducted the experiments, assisted by Prof. A. B. Crowe of the city schools and a local photographer.

## Experiments at St. Ignatius College, Chicago.

The faculty of St. Ignatius college, Chicago, gave a private exhibition of Röntgen ray experiments last week at the laboratories of that institution. The X-ray investigation in St. Ignatius college has been going on for several days, the work being done by Father Meiner, professor of science, with the assistance of J. F. Mehren, William Brown and one or two others. Numerous shadowgraphs were projected upon a screen at the exhibition and Father Meiner gave some very interesting information upon the subject, which he illustrated as he proceeded with the lecture.

It is proposed to hold the meeting of the British association for 1897 in Toronto, Ont., and it is reported that there is a possibility that the Prince of Wales may be induced to accept the presidency of the association for that year.

## Photographer's View of Röntgen Experiments.[1]

The following highly interesting communication reaches us just as we are going to press with our last form. It is from one of our special correspondents in Germany, and explains the experiments of Professor Röntgen, which for the past month have excited so much comment in the sensational press of the day, and let loose the flights of fancy and imagination in both veracious correspondent and truthful reporter. Stripped of all sensationalism the facts of the case, according to our correspondent, are as follows:

For a considerable time, various physicists have been of the opinion that the oscillatory motion or vibration of light was not only transverse, but longitudinal as well. This theory was confined chiefly to such light rays as were absolutely invisible to the eye, and entering upon the ultra-violet.

In the daily papers communications have appeared at various times regarding these vibrations, among the latest being the highly-colored accounts of the experiments by the Würzburg Professor Röntgen.

It is here stated that Professor Röntgen succeeded in obtaining photographs, by aid of these invisible rays, without the use of any photographic apparatus. This statement, impossible as it may appear at the first glance, may be explained by the following statement of facts.

If an induction current is passed through a Geissler tube, filled with rarefied air, there appears upon the negative electrode a thin seam of light, surrounded by a relatively dark, bluish glow of light.

The surroundings of the positive electrode, on the contrary, and the larger part of the enclosed space, is filled with strata of bright, red-yellow light. This phenomenon changes perceptibly when the rarefaction of the air within the Geissler tube is increased.

When a certain degree of rarefication of the air is reached the blue glow light expands, and under certain conditions fills the whole interior of the tube. When this is the case the glow light causes a fluorescence wherever it strikes the glass.

This phenomenon was studied and published by Hittorf so far back as 1889. Subsequently other scientists beside Hittorf and Crookes occupied themselves with the study of this phenomenon. Prominent among the latter were such scientists as Reitlinger, E. Goldstein, Gintl, Pubeg, Voller, Zoch; and the conclusion was reached that these cathodic rays were endowed with a series of peculiar properties.

The most curious of these qualities is that the cathodic rays spread themselves direct (*geradlinig*), and not as those of the induction current, which turn corners and follow all the turnings and twistings of the tube. This peculiarity of the cathodic rays was not discovered by Röntgen, but has been known in scientific circles since the publications of Hittorf and Crookes. The former, as well as the latter, gave very explicit instructions for experiments which would show the chief properties of the cathodic rays. Probably the best account is to be found in the well-known text-book of Müller-Pouillet.

Even the peculiarity of the cathodic rays, to show a unique shadow structure, and which now forms the leading wonder in Röntgen's experiments, has long been known, and attention had been called to it.

Now Professor Röntgen has substantiated the fact that the cathodic rays were not undulatory, but extended in straight lines, and were able to penetrate almost all solid bodies, metallic, of course, to a less degree than wood, etc.

Röntgen covered with a thick black cardboard a Geissler tube in which cathodic rays could be produced. Notwithstanding that no rays of light whatever could escape, he noticed in the completely darkened room that a screen with luminous paint, which was on line with the tube became luminous or phosphoresced. This action of the light was noticeable on the paint up to a distance of two meters from the apparatus. When any solid objects were placed between the screen and the covered tube, it was noticed that almost all substances were penetrated more or less by the cathodic rays. A pine board an inch thick had no more effect in obstructing the rays which Röntgen temporarily designates as X-rays than several thicknesses of hard rubber plates. Metals on the contrary, even in thin sheets, exercised a more or less weakening effect upon the rays. All of the super-imposed solids threw a more or less dense shadow or penumbra upon the luminous screen.

As an example, when the hand is held between the tube and luminous screen a shadow is created in which the bones of the hand are distinguishable by a much deeper shadow than that formed by the more transparent or permeable substances.

One great advantage, thanks to modern photographic methods, is that these shadow pictures can be made permanent by simply substituting for the luminous screen a sensitive plate, film or paper, which after exposure can then be developed and fixed in the usual manner; these results, however, are by no means a photograph in the accepted sense, but merely a shadowgraph or silhouette, which, under the best conditions, may consist of a penumbral shadow, showing different degrees of density.

This is all there is in Professor Röntgen's miraculous photography. If reports are to be credited, the Würzburg savant has succeeded in obtaining several interesting specimens, among which the deeper shadows in one show the bones of the hand, while in another a series of weights enclosed in a wooden box are said to be perfectly indicated. The latter is a possibility, as the wood offered no greater resistance to the X-rays than a sheet of clear glass to the rays of ordinary light.

Thus are the miraculous photographs of Professor Röntgen, taken without camera or objective, explained.

[1] From the *American Journal of Photography*.

## Nomenclature of the New Radiation.

For the class of pictures produced by the Röntgen process several names have been suggested. There is an objection to calling them "photographs," no matter what adjective is employed before the noun, for a photograph is an impression made by light, and the X-rays are not light. They are invisible. "Cathodograph" will not do, because the cathode rays are only indirectly concerned in the operation. "Radiograph" is better, perhaps, but the term is too comprehensive. The pictorial product of any other kind of radiance would be entitled equally with a Röntgen-ray image to such an appellation. The first part of "skiatograph" is derived from the Greek word for darkness, and the term affords a direct antithesis to "photograph." "Shadowgraph" and "skiagraph" mean precisely the same thing, but the former is a combination of English and Greek and the latter is all Greek. "Shadowgraph" would be constructed on better etymological principles than "shadowgraph." To satisfy the popular craving for a word containing the "graph," however, possibly it may be wiser to adopt "skiagraph." It is properly derived, is euphonious, and it is shorter than any other name yet proposed.—*New York Tribune.*

"Scotograph" is likely to stick as the popular term for portraits taken by the Röntgen process. It means "shade picture," and its analogy with photograph, which is a "light picture," is sufficiently manifest to help on its vogue. It happens, however, that the word scotograph has already been in use a number of years to designate a writing instrument for the blind, and it is pronounced as if derived from the proper noun "Scot." But it will be the simplest matter in the world for the new meaning of the word to oust the old in popular acceptance, for that is a general law of language. And despite the dictionary the first "o" will be long, as in photograph.—*New York Herald.*

So much has to be printed every day about the development in the line of Röntgen's discovery that the question of a name for the thing has become one of importance. Thus far it is called the new photography, but that is both clumsy and misleading, and the suggestion is now made by several English scientists that it be termed electography. This, however, raises the objection that all sorts of things are being done à la Röntgen without the use of electricity at all.—London Correspondence, *New York Times.*

## X-Ray Stories from Various Sources.

A newspaper correspondent sends this account from Zanesville, O.: "J. M. Rusk, a nephew of the late Jerry Rusk, secretary of agriculture, editor of the *McConnellsville Herald*, says he has been able to produce photographs of materials without the aid of the Röntgen light or the Crookes tubes and with only the most crude apparatus. At the announcement of the discovery of Röntgen's process, Mr. Rusk asserted that he could accomplish the same result without the aid of the Crookes tubes, and he accordingly made the experiment at the electric light station recently established in the village, being assisted by Kay Chandler, the local photographer. Mr. Rusk thus describes his experiment: 'I took a common No. 27 X photographer's plate; on the back of this I placed a piece of tinned iron; on the front of the plate I placed a common lead pencil; this was all done in a dark room. They were then tied up in two thicknesses of photographer's paper through which neither the light of the sun nor an incandescent light, nor an arc light would penetrate. The package was placed in a heavy paper box, this box also being closed in a second box. The package was then taken to an electric light plant and the sensitive side placed within six inches of a rubber belt, the machinery of course running and the belt statically charged. The plate was left over night in the photographer's office and developed in the dark the next morning. The result was perfectly satisfactory.' Mr. Rusk was more than elated at his discovery, and continues as follows in his statement of the experiment: 'I make this general statement, that wherever static electricity can be obtained there photographic effects can be produced. The Röntgen ray is longitudinal; it is the highest cosmic energy possessed by the atom; such a thing as matter cannot exist where the Röntgen ray exists. With the proper stresses placed upon the object to be photographed no existent matter can resist its penetrating power. It can be refracted. It is the crest of the negative electrical ray. It is the cloudland above the high peaks on which Tesla has been standing.'"

In St. Louis, according to the daily newspapers, "it has been demonstrated that the cathode rays used by Dr. Röntgen can be focused. By focusing the rays any particular organ of the body may be photographed without the surrounding tissues being shown. And it is two St. Louis scientists who have succeeded in demonstrating this fact." Chicagoans will be interested in the announcement that one of these "scientists" is Dr. Wellington Adams and the other his old friend, Professor Nipher of Washington University. From the same sources of information it is learned that "they have been using a Rumkolph coil to generate rays and a Ceisler tube, and have succeeded in securing a shadowgraph that has encouraged them to renew their efforts." The experiments conducted by these distinguished gentlemen are thus described: "An ordinary micromatic screw was placed in its wooden case and put immediately in front of a sensitive plate. Then the intense penetrating ether waves or cathode rays, were produced in front of the case. The result was that the bulb or round portion of the screw was photographed through the wooden cover, but the flat portion failed to outline on the sensitive plate. Several other objects were subjected to the same test without the same result. Commenting upon this the recorder of these scientific truths says: 'This fact was established, however, by these experiments that the rays can be focused, for the shadowgraphs produced were smaller than the articles photographed. This demonstrates that with the proper conditions the rays can be focused on a given article or portion of anatomy and an image photographed.'"

The New York *Sun* gives the weight of its influence to the abominable term X-graph which it employs in a news item from Worcester, Mass., which is herewith reproduced: "A small party of ladies and gentlemen were invited to one of the laboratories of Clark University yesterday afternoon by Professor Arthur C. Clark to see the process of making X-graphs with the X-rays discovered by Professor Röntgen. Dr. Webster is taking this subject up as a digression from the work on which he is occupied, and does not propose to carry his investigations very far. There are enough men already at work on it all over the world. He desired to test for himself the reality of the discovery, and he freely admits its importance and great possibilities. He has successfully made the ordinary experiments so often described. He does not use electrodes. The place of electrodes inside the bulbs is supplied by caps of foil outside."

Among the myriad reports of fresh experiments during the week that from *Le Gaulois'* office is most striking. Two journalists there succeeded in photographing a letter through the thick manilla envelope used by the French Parliament by wrapping it in a sheet of tinfoil off a chocolate packet. In France, where private documents just now play a chief part in the government of the country, this ought to be especially useful.

It is stated in the *Deutsche Photographen Zeitung* that seven more interesting results in cathodic photography have been obtained by Carl Zinck of Gotha, Germany, than by the Würzburg professor. Carl Zinck is the well-known photo-scientist and inventor of the simplified photo-chromoscope.

"The acid test of this new photographic process," observed Rivers in the *Chicago Tribune*, "will come when they try it on a shad."

## Bell Telephone Outlook.

Boston is the home of the American Bell Telephone company, and the following from the financial daily of that city, the *News Bureau*, may be accepted as a Bell statement of the telephone situation:

From the annual returns of the various sub-telephone companies operating in the United States an estimate can be made of the extensive telephone work done during the year 1895. The expenditures of the New England company for extensions will exceed $1,000,000 and of the Erie company over $600,000. The former company will make a net gain of more than 4,000 subscribers and the latter 2,419. The increase throughout the country will exceed any period in the history of the telephone business and will probably not be far from 35,000 subscribers. The Long-distance company has made a wonderful advance, reaching into Kentucky and Missouri, and it is roughly estimated that this company, together with all the sub-companies, has spent from eight to 10 million dollars in improvements and extensions during the year.

Before the close of 1896 the Long-distance company will evidently reach out to every important city south and west as far as Omaha, including New Orleans in the South and Minneapolis, St. Paul and Duluth in the Northwest. Montreal and some of the large Canadian cities will soon be connected into the general system.

The sub-companies are rapidly covering all local points within their territory with metallic long-distance copper wires to connect with the long-distance system. The growth for the next few years promises to exceed the past and in all probability the entire subscription lists of the sub-companies will double in the next five or six years. It has required from seven to 10 years to double the subscribers in the past. Seven years ago the ratio of telephones to population was in cities numbering from 40,000 to 100,000 population about one to every 100; now it runs from one to 50 and one to 100, averaging one to 75.

The remarkable increase in subscribers is attributed in part to the introduction by the sub-companies of the measured and party-line service, thereby enabling a class of people to have the telephone that heretofore could not afford the unlimited rate charged. The introduction of this service has met with universal approval and by the addition of so many new subscribers the value of the service to those paying the unlimited rate has been largely increased.

The increase of subscribers for 1896 bids fair to exceed 1895.

The cost of the addition of new subscribers is not so great in proportion as the original of a telephone plant, and the return is a fair one upon the cost, and in addition to this adds to and strengthens the original outlay and capital invested.

It is understood that the appropriations for extensions in the New England company for 1896 will be at least $1,200,000, and that the Erie company will spend in the neighborhood of $500,000. This expenditure in the former company ought to increase its subscription list to 32,000 and the list of the latter company to 21,000, besides erecting several exchange buildings contemplated, extension of the metallic long-distance and underground plants.

It has been found advisable that where 1,000 or more subscribers are connected with a single exchange, that on account of the underground plant and safety of the valuable switching apparatus that the companies should construct their own fireproof buildings upon a permanent location. A building, however, for 1,000 subscribers at the beginning need not cost much in excess of $15,000. The future of the telephone is certainly very promising and no security has stood the financial depression better.

By its annual report the Southern New England Telephone company shows gross receipts of $503,715.55 and net earnings of $111,903.20 for 1895. The company paid 5¾ per cent. dividend on $1,500,000. The number of stations increased from 5,536 to 6,830.

## Are Telephone Companies Common Carriers?

In considering the legal responsibilities and limitations of telephone companies in making schedules of rates, some judges have held that such companies are common carriers, and that, as such, their charges form a proper subject for the consideration and supervision of the courts in the general public good. This view is combatted by the Bell telephone companies, but has been advanced by a New York city judge, in a case now pending, and later by a Nebraska judge, as seen by the following report from the Minneapolis correspondent of the WESTERN ELECTRICIAN:

"Wooley & Gibson secured a verdict for $60.80, with interest, against the Nebraska Telephone company, at Lincoln, Neb., for overcharges the defendant had compelled them to pay for the use of a telephone for 31 months. The court ruled that a telephone company was a common carrier whose rights and duties were fixed by law and it is bound by law to charge a reasonable rate. No evidence was introduced to show that it cost the company more to furnish Wooley & Gibson an instrument than it did to furnish one to other firms who were mentioned, who were charged a less rate, and it was held that the lowest rate was reasonable. The jury was instructed that the company had no right to discriminate, and having left the jury in the dark as to the expense undergone in furnishing telephones to different parties, the company must be considered as having discriminated against the plaintiffs. The telephone company will appeal the case to the Supreme Court."

# CORRESPONDENCE.

## New York Notes.

NEW YORK, February 21—Dr. Pupin's experiments at Columbia College with that form of radiation to which Röntgen called attention have led to valuable results and have perhaps attracted the most attention among scientific men of any undertaken in and about New York. Prof. Samuel Sheldon of the Brooklyn Polytechnic Institute has also secured some interesting results. Among other experiments he secured a remarkable picture of a silver half-dollar. A sheet of lead was placed on a rubber slide one-eighth of an inch in thickness. Upon the slide was placed a photographic film wrapped in black paper. The 50-cent piece was then put in place and another plate of rubber and another of lead were placed over it. This condenser so formed was connected in parallel to the terminals of the secondary coil and left for 15 minutes. The stress on the dielectric produced by the high difference of potential between the lead plates caused a corresponding stress on the photographic film. Professor Sheldon believes that it also produced a glow. The impression of the coin was so marked that it could be plainly seen before the plate was developed. Upon developing the plate not only the outline of the coin, but the outline of the figure on the coin, could be discerned.

The *Herald* gives an entertaining account of a meteorite, or fire ball, which was observed at sea, during a gale, on board the freight steamer Brooklyn City, from Swansea for New York, on February 11th. Your readers will be interested in the manner of presenting the story:

Chief Officer Ellis, muffled to the ears, clung to the bridge and longed for warmth and comfort. He was thinking, he admits, of a cosy cabin, where stewards could at command brew a certain drink called hot Scotch.

"I wanted a hot ball, as you New Yorkers say," he remarked to me. "A high ball, I believe you call an especially large drink. Yes; I wanted a high, hot ball."

He got it. A blinding flash of light blazed upon the truck of the foremast. There came the sharp crack of lightning and the sound of splintering wood. The truck split in two, fell to the deck, and a big splinter of the foretopmast came clattering after. That "high, hot ball," a globe of fire two feet in diameter, ran down the foremast quicker than any sailorman could ever dare go. It gleamed with an intense, white light, as though it were metal heated to the highest point. It illumined mast and

rigging with a strange, ghostly light. The sailors ran aft and the first officer rolled his eyes and stared.

He had seen fire balls fall into the sea before, but this was the first he had ever taken aboard. Then this big, white, hot globe struck the deck and burst into a thousand brilliant fragments like a big rocket. After the flare all was dark again, and when the sailors went to find some of it they could discover no trace. It had vanished in air. There were plenty of splinters on the deck, though, and the ruins of the highly ornamental truck.

J. T. C.

## New England News.

BOSTON, February 20.—The Board of Railroad Commissioners of Massachusetts has submitted to the Legislature advance copies of its annual report for the year 1895. For the first time the board considers at length the adoption of electricity in place of steam, and under the caption "Electricity as a Motive Power" gives 17 pages of its report to a discussion of that subject. The report concludes as follows:

It is, perhaps, unnecessary to add, that there is no apparent demand by the public for the substitution of electricity for steam in general railroad operation. No complaint has come to our ears that the present railroad service, so far as the motive power is concerned, is inadequate or unsatisfactory. The question, as it now stands, is one purely of economy, to be decided by the railroads primarily in their own interest, bearing in mind, as they will, that it is always for their interest to give to the public the best service reasonably in their power. Our railroad managers, we have reason to know, are giving to the subject their diligent attention and study; and they will be alert to introduce the new motive power upon their lines so soon as it shall become manifest that by so doing they can give to the public a substantially cheaper and better service.

The second half of the commissioners' report relates entirely to street railways. Massachusetts companies now own 907.988 miles of street railway line, 169,097 miles of second track, and 67,523 miles of sidetrack—making the total length of the track owned 1,155,250 miles. The whole amount of cash dividends declared and paid the last year was $1,606,196—an average of 5.76 per cent. on the total amount of capital stock outstanding at the end of the year, as against 5.97 per cent. in 1894. Only 33 of the 75 companies paid dividends in the last year. On company paid nine per cent.; one (the West End) paid eight per cent. on preferred stock and 6½ per cent. on common stock; seven paid eight per cent.; one paid 7½ per cent.; ten paid six per cent.; two paid five per cent.; one paid 4½ per cent., three paid four per cent.; four paid three per cent.; two paid 2½ per cent.; one paid two per cent.; and the remaining 42 companies declared and paid no dividends.

C. S. G.

## Washington, D. C.

WASHINGTON, February 21.—Representative Grout of Vermont has introduced a bill in Congress to authorize the extension of the lines of the Potomac Light & Power company. The bill directs that all construction shall be under supervision of the District commissioners, and no overhead wires shall be used within the city limits. Outside of the city, where overhead wires shall be used, provisions will be made for at least four wires, and the commissioners may use the same, free of cost, for telegraph, telephone or fire alarm service. The company also agrees to allow the commissioners a duct four inches square and as long as their lines may be, free of charge. All ducts are to be kept in good repair, and, if the commissioners desire, the company will build 10 extra ducts to be rented to others.

The Columbia & Maryland Railway company has given a contract to the Westinghouse company of Pittsburg to build two power houses on its proposed trolley line between Washington and Baltimore. Both will be substantial buildings 120 by 250 feet, equipped with the latest electrical appliances, and the contract calls for their completion by May 15th.

It is understood that the Georgetown & Tennallytown Railroad company is endeavoring to purchase the Tennallytown and Rockville road, better known as the Bethesda line, and has offered that corporation within $2,000 of the price asked. If the deal is consummated the Georgetown corporation will begin at once the extension of the Bethesda line to Rockville, over a route which has already been surveyed. Electric light wires will be strung along the line of the new road, and light will be furnished to those who want it.

In the annual report of the Washington & Marlboro Electric Railway company, which has been transmitted to Congress, is the statement that an amendment in the act of authorization requires it to pass over the Anacostia river by the bridge constructed with a draw apron. This is believed by the company to be an impossible thing in an electric railway line, involving also a perpetual menace to the safety and lives of passengers. It was therefore judged unwise to take further steps until some mode could be devised and the sanction of Congress obtained to obviate so grave a difficulty. All subscriptions of stock are consequently held in trust by the directors for the benefit of the company.

It is claimed that the electricians of the Capitol work too many hours a day; 11 and 12 hours is the rule, with an occasional Sunday thrown in. Each year has seen an increase in the use of electric lighting at the Capitol. It was only at the beginning of the present session, however, that Congress owned its own plant. Twelve men are required at the Capitol to look after the motors, wires and lamps that furnish the committee rooms and both legislative chambers and the Supreme Court with electric light. Eight of the men are required to look out for the lights during the day, and four at night. All of the men are overworked, and say that their lot is such a hard one that it is almost unbearable. They claim that by the addition of even four more men the work for all would be considerably lightened, and they could get a little time to go home to their families. Mr. Gleim is the head electrician at a salary of $2,500 a year. The next highest salary under his own is $1,440. This salary is received by five of the electricians. Three more receive $1,080 each year. The remainder of the men get $720 each. It is claimed that two of the recipients of the $1,440 salaries are relatives of Mr. Gleim, and a third member of the family draws one of the $1,080.

## Detroit, Mich.

DETROIT, February 21.—The matter of greatest importance to the electrical interests in Detroit for some days past was the awarding of the contract for electrical machinery and wiring required at the new factory of the Schilling Corset company. Competition was very close. The Fontaine Crossing & Electric company secured the contract for one 50 kilowatt generator, four two-kilowatt motors and 10 one kilowatt motors. The wiring for about 600 lights and the motor service was awarded to the American Electric company. In addition the factory will be equipped with electric signals and a complete telephone system, and when completed will be as finely arranged and thoroughly complete an equipment as can be found anywhere. The motors are required for running sewing machines and other apparatus used in the manufacture of corsets. Motors will be attached to the center of line shafts by cut gears and raw-hide pinions, one motor being used on each table for 20 to 25 machines. Humphrey & Carr are the engineers for this plant.

C.

## Northwestern Notations.

MINNEAPOLIS, February 20.—Charles City, Ia., will vote March 2d on granting the Hildreth Hotel & Opera House company a franchise for an electric line.

The receivership of the General Electric company of Winona, Minn., cannot be terminated as soon as expected. A committee consisting of John S. Bartlett, Anthony Perry and Winthrop Coffin of Boston, representing the stockholders, is now paying such unsecured claims as are construed just and legitimate.

The committee from the Commercial club in St. Paul, which appealed to the street railway company for a loop to connect the retail district with the Union depot, received encouragement to believe that the loop would be put in next spring.

The Central Wisconsin Electric Railway company of Oshkosh, Wis., has failed to comply with the terms of the extension of its franchise which required that 2½ miles be built by February 1st or a guarantee of $5,000 put up as security, but J. K. Tillotson, the promoter, says that the line will be built. A suit against Mellen & Co., who are alleged to have jumped their contract, is promised by Tillotson, who says they are to blame for the present delay. There is a rumor in Oshkosh that the emphatic declaration that the road will be built is based on a deal recently made with the Oshkosh Street Railway company.

E. B. Hosford, the manager of the Electric Light company of Anaconda, Mont., has mysteriously disappeared.

C. E. Mosier, one of the bondsmen of W. M. Hewitt, receiver for the Stillwater Street Railway company of Stillwater, Minn., has applied to the court to be released from the bond, and this action will probably result in winding up the receivership matter.

A decision has been handed down in the case of the St. Cloud., Minn.,, Electric Railway company, by which the claim of Morrison and Lyons to the electric line is knocked out. They held a tax title. The ownership is not settled, however, as no decision is made as to the identity of the bondholders, or how much is due on the several bonds that have been issued, and this question will be referred to a master in chancery.

The Sheldon, Ia., electric plant will be enlarged.

Richardson & Sanderson of Hills, Minn., have added a 250 light dynamo to their feedmill and will furnish the town light.

The council of Little Falls, Minn., has annulled the contracts for electric light and water.

Al. Kauffman was arrested at Council Bluffs, Ia., for obtaining money under false pretenses at Atlantic, Ia. He represented himself to be an inspector of the Postal Telegraph company from Chicago, and secured advances of money from the office at Atlantic. He also forged the manager's name to an order guaranteeing the payment of his hotel bill.

G. W. Hoskell, manager of the electric light plant at Austin, Minn., has gone to Revere, Mass., to accept a similar position.

C.

## PERSONAL

Walter C. McKinlock, secretary of the Metropolitan Electric company, has the sincere sympathy of the electrical fraternity on the occasion of the recent death of his baby boy.

## ELECTRIC LIGHTING.

C. P. Woodworth of Carrollton, Ill., has been granted a 10-year franchise for electric lighting and has closed a five-year contract for furnishing 35 arc lights to the town at $60 each per annum.

The negotiations which have been in progress for some time past with the object of effecting a closer business relationship between the Toronto Electric Light company and the Incandescent Light company of Toronto are understood to have resulted in an amalgamation of the interests of these companies. The bulk of the stock of the Incandescent company has passed into the hands of the Toronto Electric Light company, while, on the other hand, several of the directors of the Incandescent company have acquired stock in the older company, and will occupy seats on the board of directors of the amalgamated concern. It is stated that Frederic Nicholls, the organizer and manager of the Incandescent company, will shortly retire, and the management of the amalgamated concerns be placed in the hands of J. J. Wright, the present manager of the Toronto Electric Light company. It is believed that Mr. Nicholls will be a director of the new company. Authority will be sought to enable the company to increase its capital stock to at least $1,500,000.

## ELECTRIC RAILWAYS.

It is proposed to establish a summer school on Eagle Island, in Sodus bay, on the north end of Chautauqua. Sodus bay is a picturesque inlet on the southern shore of Lake Ontario, about 40 miles east of Rochester, and it is possible that an electric railway may be built to connect the city and the resort.

The financial column of the *Chicago Evening Post* of February 17th contained the following: Word was received from Philadelphia to-day that the Englewood & Chicago Electric Street Railway company has called the first installment of 10 per cent. upon the subscription of the bonds and stock of the company, payable February 24th. Negotiable receipts for the payment will be issued by the Manhattan Trust company of New York. The Englewood & Chicago Electric Street Railway company, in which a number of Philadelphia capitalists are interested, will be the first complete street railway to be equipped with the electric storage battery. The road will have 54 miles of track and will run through a territory which is now without railroad facilities. It is expected that the road will within a short time be extended into the heart of Chicago through another charter which is now in contemplation.

The project for a trolley line from Camden, N. J., to Atlantic City, which has been discussed for several years, has again been revived, and capitalists of Philadelphia, New York and Camden are said to be interested in the plan. A conference was held recently and a number of reports submitted by experts were discussed. It is proposed to organize a company with a capital of $2,000,000. Agents, it is said, have obtained options on all old rights of way across New Jersey. It is intended to maintain express accommodation and freight service. Entrance to Camden will be secured over the tracks of the Camden, Gloucester and Woodbury trolley road, from which the new line will branch off at some point below Washington Park. Ordinances are now before the city councils of Camden and Atlantic City for street and terminal privileges, and if these are granted, which will probably be done, as popular feeling is strongly in favor of the new road, work will be started as soon as spring opens.

## POWER TRANSMISSION.

Plans for the construction of the great hydraulic and electric plant, by which the Susquehanna river will be used to furnish electrical power to towns in Cecil and Harford counties, Maryland, manufacturing places along the Susquehanna in Pennsylvania, and also points in Delaware, have been completed by Clemens Herschel

of New York, who had so much to do with the Niagara electric plant. Work will be begun in the early spring, and in less than a year's time the company expects to be able to furnish power as far north as Wilmington, Del., as far south as Baltimore. The company has acquired most of the land fronting on the Susquehanna river between Conowingo, Md., and the Pennsylvania state line. A great dam and a system of canals will be constructed, in which will be placed the penstocks and turbine wheels for generating the electricity, the whole plan being somewhat similar to the Niagara Falls system. Under its charter the company may carry on any manufacturing, mechanical, industrial or chemical business in which electricity over or through wires can be applied. Messrs. Elkins and Widener of the traction syndicate and other Philadelphia, Pittsburg and Baltimore capitalists are interested in the company.

The electrical equipment of the extensive cotton mills of the Pelzer Manufacturing company, one of the largest cotton goods manufacturing concerns in the South, is rapidly nearing completion. The motive power is derived from Victor turbine water wheels driving three 750 kilowatt three-phase generators, wound for 3,300 volts. The water wheels turn at a speed of 164 revolutions per minute. The electricity generated at the power house will be carried a distance of 3½ miles to Pelzer, where it will enter the mills and drive four motors one 400 horse power synchronous motor wound for high potential, and three multiphase motors of varying capacities from 100 horse power up to 125 horse power. The majority of these motors will be of the inverted type, suspended from the ceiling in the different rooms. They will receive the current at a low potential from step-down transformers placed in the sub-station at the mills. The motors will be lighted from the same circuit. The system utilized in the operation of these mills is the three-phase system developed by the General Electric company. It is also in use at the Columbia mills at Columbia, S. C., and at the Ponemah mills at Taftville, Conn.

An English exchange reports that Siemens & Halske of Berlin have in course of construction a long-distance transmission plant which is to be operated by the "Empresa Eléctrica de Guatemala," and which is intended to carry electric energy for light and power purposes to the city of Guatemala from a waterfall 425 miles distant. The system of transmission is the three-phase, at a pressure of 10,000 volts, with step-up and step-down transformers at either end of the line. Power is to be derived from the outfall of a lake giving 2,000 liters per second, and with a fall of 87 meters. At present 1,300 horse power is available, but it is contemplated to carry out works permitting the water of the lake to be accumulated during the daytime, this will bring the available power to 5,000 horse power. The plant now in view consists of a set of two horizontal Nagel and Raemp turbines of 520 effective horse power each, running at 200 revolutions per minute. Each turbine is coupled direct to a Siemens & Halske three-phase alternator capable of generating 425 kilowatts at a pressure of 350 volts. The current is transformed by a set of four transformers from the pressure of 350 to 10,000 volts, then transmitted to the town by a three-conductor aerial line having an aggregate section of 105 square millimeters, the maximum loss in the line amounting to 10 per cent. On reaching the town the pressure is lowered again by another set of four transformers from 9,000 to 1,000 volts, the current being then distributed to the supply network of the town. The distributing conductors are overhead, carried on iron poles.

## MISCELLANEOUS.

Various devices have been invented for enabling the cyclist to train or take his exercise indoors during bad weather. It has occurred to a French electrician that he might at the same time be doing some useful work. Accordingly, an apparatus is described by which the driving wheel of a safety bicycle of the usual type is raised from the floor and by means of a strap and speed gearing drives a small dynamo which is used to charge accumulators. The arrangement is designed to give a current of seven amperes at 20 volts.

The newly organized Technical Club of Chicago probably will be housed temporarily on the second floor of the Grand Pacific hotel. The organization has been completed by the election of the following named officers: President, Robert W. Hunt; vice-presidents, W. I. Babcock and E. C. Shankland; treasurer, H. F. J. Porter; directors, Dankman Adler, B. J. Arnold, Charles E. Billin, J. R. Chapman, B. M. Gardner, E. M. Herr, George H. Lederle, James F. Lewis, Alfred Noble, Isham Randolph, A. Sorge, Jr., John F. Wallace.

## TRADE NEWS.

A. O. Schoonmaker of 158 William street, New York, is now building his solid sheet mica segments to required thickness, ready for use. He is prepared to cut mica to any pattern or shape that may be wanted.

The widely known firm of Darling, Brown & Sharpe of Providence has issued a booklet, which will be sent on application, describing its standard and tempered steel rules in many graduations in English and metric measurements.

Roofs painted with Dixon's "silica graphite" paint have not required repainting in 12 to 15 years and over. Railway and other corporations known for their thorough testing and careful selection of materials use this paint in large quantities. Anyone desiring to know more about graphite paint should address the Joseph Dixon Crucible company, Jersey City, N. J.

The universal interest displayed by physicists in Röntgen's recent discovery has developed an unprecedented demand for the salts of platinum, which fluoresce under the impact of the X-rays. Baker & Co., the platinum refiners of Newark, N. J., state that they have sold more of the particular salt recommended by Röntgen as most suitable for X ray experiments namely, barium platinocyanide than ever before in the history of their business, and that, in consequence of the undiminished demand for this salt, they have been obliged to increase their laboratory force.

The contract for the private telephone exchange for the Lincoln Park Palace, Chicago (a building consisting of 70 apartments and stores), has, after a spirited contest among the local telephone contractors, been let to Richards & Meacham, 84 La Salle street, agents for the auto-telephone system. This installation will include a central "auto" switch-box, located in the office of the building, by which connection may be had with any of the 70 flats and stores. The increasing popularity of the auto-telephone speaks well for the merits of the instruments. Richards & Meacham are prepared to furnish telephones from Chicago stock on short notice.

O. S. Platt of Bridgeport, Conn., has incorporated his business under the laws of the state of Connecticut, and adopted the name of the O. S. Flat Manufacturing company. He will continue the business of manufacturing the manufacture of the well-known New England switches and specialties generally, at the old stand, 88 to 102 Cannon street, Bridgeport. The business has been carried on since 1880 by Mr. Platt alone as now the president and general manager of the new company. Charles J. Knapp secretary of the company, a man of business experience, was formerly of the Swords Lumber company. He will have charge of the office affairs. With the new facilities with new management brings, the company will be in shape to fill all orders promptly, and to give more attention to the constantly increasing trade in the electrical line, which has heretofore been necessarily more or less neglected.

The Washington Electric company, which has been located so long in the Springs building, 209 South Canal street, has moved to more commodious quarters in the Russell building, 31 West Randolph street, corner of Canal street, Chicago. Several years ago this concern started in a small way and has been growing until a steady and large increase in business has necessitated the removal to the larger factory in the Russell building. President W. O. Meissner of the company states that it has been found necessary to add a great deal of new machinery in order to fill the increase in orders. Mr. Meissner is an experienced electrician and mechanician, and undoubtedly the company's success is largely due to his skill and experience. The company is now manufacturing high-class telephone specialties of all kinds, and also a complete electrical line of novelties, such as stage dimmers, focusing lamps; it is also doing considerable experimental jobbing.

One of the most attractive of recent specimens of advertising literature is the handsome pamphlet just issued by the Simplex Electrical company. It is entitled "A Few Buildings," and represents, with the aid of beautiful illustration, letter-press, paper and binding, some of the fine buildings wired with Simplex wire. The list is an imposing one, and as many of the best buildings in the country are included, where material of recognized excellence is required throughout, such an extensive use of Simplex insulation does indeed speak well for this standard wire. The illustrations are of a high order of excellence, and the book is well worthy of preservation as a pictorial record of American architecture. It is believed that the happy idea of presenting "A Few Buildings" in this manner originated in the fertile brain of H. R. Hixson, the wide-awake western agent of the company, whose office is at 1137 Monadnock block, Chicago. Mr. Hixson is to be congratulated on his work.

## BUSINESS.

The Edison Electric company, New Orleans, La., has increased its power by the addition of a 300 horse power Ball engine, manufactured by the Ball Engine company, Erie, Pa.

The Novelty Manufacturing company of Winchester, Ky., has just been organized to do experimental work and supply electrical and mechanical specialties. It is in the market for small machines of merit.

The Electric Appliance company has been pleasantly surprised at the way in which its wire sales have held up since the first of the year. It is usual to look for quite a falling off in this material after January 1st, but the demand for both "O. K." weatherproof wire and Paranite rubber covered wire has been exceptionally good, much to the satisfaction of both the manufacturers and the Appliance company.

The Stromberg-Carlson Telephone Manufacturing company has just closed a contract to equip the city of Detroit's police signaling system with 300 of its instruments. This order was secured after considerable competition and speaks well for the merits of the Stromberg-Carlson instruments.

The Metropolitan Electric company is putting on the market a double coil filament incandescent lamp for street car use. This lamp is found to give unusual satisfaction for this class of work. It resists jarring; the filament will not break, and the lamp is long lived, without any appreciable blackening effect. The company has just received a large stock of knife switches from Evanson & Armbrester, Philadelphia, for whom it is general western agents. N. J. K. wire has been specified in several large installations lately, and the Metropolitan Electric company carries a large stock on hand and sells this wire in the West. Customers say it gives perfect satisfaction.

The United States Telephone Construction company of Philadelphia has moved its offices from the Bullitt building to very handsome quarters in the Philadelphia Bourse. It has also largely increased its capital and is going into the telephone business on a much larger scale than heretofore, the plan being to organize state or sub-companies to cover the entire United States, and allow these companies to manufacture their own instruments when desired, thus giving each sub-company all the manufacturing profit and an opportunity to meet all local requirements. If the Berliner patent is sustained by the United States Supreme Court, this company, owning and controlling the Method patent for a make-and-break telephone, will, it is claimed, present practically the only opposition the Bell company will have. The company makes five styles of telephones, and guarantees each one of them to be absolutely non-infringing in every particular. Its new long-distance instrument is guaranteed to talk over 6,000 miles of resistance and is said to be superior to any telephone on the market.

Friends of George P. Townsend will be interested to know that he has recently been appointed western manager for the Keystone Electric company of Erie, Pa., with headquarters at 1222 Marquette building, Chicago. Mr. Townsend is an experienced man in the electrical business. He started in the Edison Chicago company in 1889, was next identified with the Edison General company, and up to February 1st has done most excellent work for the western office of the General Electric company. The merits of the machinery of the Keystone Electric company are already so well known in the West that it is only reasonable to prophesy that Mr. Townsend's experience will bring about a rapid increase in the already growing business of the company. These machines are built both for lighting and power and are either shunt or compound wound as the case may require. The Keystone company makes a specialty of elevator equipments, and the fact that its machinery has been adopted by the Chicago Edison company for its Adams street office building, is a testimonial that speaks for itself most decidedly in favor of Keystone apparatus.

A statement to the effect that the National Conduit Manufacturing company of New York has laid nearly 20,000,000 feet of its material in the principal cities of the United States and Canada during the last fifteen years will give an idea of the enormous proportions to which the business of this concern has grown. It was difficult when the company first offered its material for sale to get the attention of the purchaser, but when an order was secured the proof of the statements as to durability and high class construction was soon recognized, so that to-day the National Conduit Manufacturing company can refer to nearly every prominent city as to the practical workings of its installation, which has made it possible for any city or town to place its telegraph and telephone wires underground, and pave the streets without fear of having to disturb them on account of poor conduit construction. This concern is also placing a large amount of material in hospitals, institutions and private residences throughout the country, and in order to meet demand orders it carries a stock of about 500,000 feet of three-inch conduit, which can be shipped at telegraphic notice, showing the readiness of the largest organized construction plant in the country. The company has arrangements whereby 500 men can be placed at work in any city in the country at 10 days' notice.

Congratulations are extended to the Cutter Electrical & Manufacturing company of Philadelphia upon the information that on February 15th the affairs of this company was discharged in open court in Philadelphia, and the company is now doing business under its original title. Henry B. Cutter started an electrical manufacturing establishment in the Bullitt building in Philadelphia, and the business grew to such large proportions that the Cutter Electrical & Manufacturing company was incorporated July 7, 1891. It did a large and successful business, but, owing to some large accounts which it was unable to collect, it applied for a receiver August 15, 1895. Exactly six months later the company completed a settlement, paying 100 cents on the dollar, and with less expense than has been occasioned by any assignment in the electrical business for a long time, being only the actual outlay for the lawyers' fees. The stockholders of the company thought best to have an assignee appointed for the protection of all interested, since which time they have been doing a good business, which is indicated by the quick settlement of their affairs. A. Edward Newton has become actively identified as treasurer of this company. He is a gentleman well known in business circles of Philadelphia and is a decided acquisition to the executive force. Arrangements are now being made to add to the machinery, that the manufactured product may be increased in all its branches. H. E. Harrington will continue as the electrical engineer and expert; his productions are well-known in the electric light and street railway trades. President Henry B. Cutter was re-elected at a meeting held by the stockholders of this company last week, and to his efforts more than to anyone else, is due the honor of having brought the affairs of the Cutter Electrical & Manufacturing company to such a successful conclusion.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued February 18, 1896.*

554,656. Telephony. Frank R. Colvin, New York, N. Y. Application filed November 24, 1894.

In a party telephone line there is claimed the combination with a plurality of sub-stations, of a metallic circuit, the two limbs of which extend through all of the sub-stations, a normally open bridge at each of the sub-stations, a microphone or battery transmitter directly included in each of the bridges, a battery connected in circuit at each sub-station, means at each sub-station for closing the bridge, whereby two telephone sets may be looped into circuit for conversation, a signal transmitting instrument at each sub-station located in a branch extending from one of the metallic limbs to ground, and a signal receiving instrument at each sub-station located in a branch extending from the metallic limb to ground.

554,664. Means for Supporting and Insulating Electric Conductors. Thomas T. Eckert, New York, N. Y. Application filed December 8, 1894.

A metallic pin with a cap of wood, paper or other insulating material, the whole being covered with a casing of insulating substance.

554,670. Induction Machine. Walter K. Freeman, Fort Wayne, Ind. Application filed July 5, 1895.

One claim is given: In a consequent pole induction machine, the combination with the base having the cheek-pieces projecting upwardly therefrom of the oppositely arranged movable field pieces clamped between the cheek-pieces and inclosing the space for the armature, the pole pieces and cores projecting from the bodies of said field pieces, and the consequent pole piece formed by a portion of each field piece.

554,671. Heat Regulator. Emil Frischknecht, New York, N. Y. Application filed March 9, 1895.

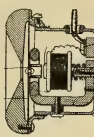
A thermal circuit closer for heat regulators and other purposes is described, consisting of a movable electric contact, means for moving the same upon a change of temperature, an adjustable contact having a metallic and an insulating portion, and conducting guides for the latter contact adapted to be connected with an electric circuit.

554,694. Trolley Support. Frank E. Homer, Cleveland, Ohio. Application filed November 30, 1894.

The claim: In a suspended trolley pole support, the combination of a sleeve socket, a base frame, equalizing chain loops secured at their extremities to the upper and lower portions of the socket, and coiled springs secured at their outer ends to the base plate, and at their inner extremities to the chain loops.

554,716. Electrical Connecting Cord. Charles H. McEvoy, Lowell, Mass. Application filed May 15, 1895.

Two covered conductors are inclosed in a common covering, and project from the ends thereof, and one or more suspension cords are arranged in the covering, the ends of the covering being turned in.



NO. 555,051.

554,719. Conduit Electric Railway. Wilhelm Oesterlein, Cincinnati, Ohio. Application filed September 21, 1894.

A support for electric conductors is a feature of the invention, embodying a supporting stem and a stand in which the same is carried, provided with means for maintaining a body of oil surrounding and in contact with the stem in such relation as to prevent or intercept the passage or accumulation of any moisture that might connect the stem and stand electrically.

554,759. Electric Battery. Charles Willms, Baltimore, Md. Application filed May 3, 1893.

The combination with a cell support, of a battery cell having the enlarged cell-supporting terminals bent outward at their outer ends.

554,760. Electric Battery. Charles Willms, Baltimore, Md. Application filed January 19, 1894.

Included in the claims is the combination with the cell, of the cell case having the screw rods, cap on the cell case, nuts securing the cap on the screw rods, cell terminals passing through the cap, rigid terminals carried by the cap, and nuts on the rigid terminals making contact with the cell terminals.

554,761. Electric Battery and Method of Sealing Battery Cells. Charles Willms, Baltimore, Md. Application filed July 12, 1894.

This method of sealing a battery cell consists in inserting outside the battery fluid a plug of viscous material, inserting outside of and upon the viscous plug a supporting plug, and inserting outside of and upon the supporting plug a sealing plug in a plastic condition, and formed of plastic material which expands on setting.

554,766. Electric Clutch. Thomas A. Briggs, Niagara, Canada, and William A. Philpott, Jr., Niagara Falls, N. Y. Application filed June 25, 1895.

The cut shows an electric clutch, in which there are a rotary electro-magnetic disk, a clutch wheel surrounding the face of the disk, and clutch armatures arranged between the opposing faces of the disk and wheel, the armatures being coupled with the wheel to rotate therewith, and capable of movement toward and from the disk.

554,8[illegible]. Electric Door Operating Apparatus. Oliver H. Hicks, Chicago, Ill. Application filed August 24, 1893.

The apparatus employed includes a rotary shaft carrying a clutch member and connected with the door to operate it by rotation of the shaft, electric primary actuating means, [illegible] an electric mat, in a generator circuit, a normally rotating shaft carrying a clutch member, an electro magnet in circuit with the primary actuating means, and having a [illegible] pivotal armature and a lever engaging one of the clutch members and connected with the armature to be [illegible] by its movements.

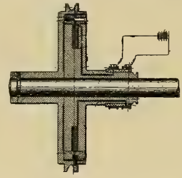
554,8[illegible]. Electric Door Operating Apparatus. Oliver H. Hicks and Robertus F. Troy, Chicago, Ill. Application filed August 8, 1895.

One feature [illegible] in combination with a door, and [illegible] mechanism in controlling the operation of the mechanism and divided into sections, one section being inoperative to control the mechanism in one position of the door and operative to control the mechanism in another position of the door.

554,821. Electro-magnet. James Houlehan, Chicago, Ill. Application filed May 10, 1895.

A set of wire-wound soft-iron cores and pole pieces is employed, successively of opposite polarities at the outer ends of the cores, the pole pieces comprising segments joined together end to end and forming an annulus, the segments being composed alternately of soft iron and non-magnetic solid material.

554,836. Machine for Connecting Electric Conductors. Harlie J. Savory, Somerville, Mass. Application filed April 17, 1893.



NO. 554,766.

This is a machine for connecting a small electric conductor to a larger one by upsetting the former within a perforation in the latter, and comprises a frame to embrace the larger conductor, an upsetting screw screwed through a screw-threaded perforation in the frame, a stationary clamping-jaw made integral with the frame, a second clamping-jaw movable upon the frame toward and from the stationary jaw, a clamping-screw screwed through a screw-threaded perforation in the frame to move the movable jaw in order to clamp the smaller conductor between the clamping-jaws.

554,859. Rail Bond for Electric Railways. Robert C. Brown, Somerville, Mass. Application filed March 21, 1894.

A hollow plug is inserted through each of the rails to be connected, and a tie-wire is extended through the hollow plugs and joined together at its ends.

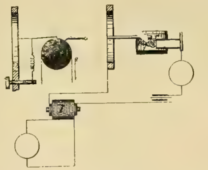
554,862. Means for Recording and Reproducing Impulses. William H. Cooley, Brockport, N. Y. Application filed April 16, 1889.

In combination with a recording surface, having a record thereon, changing in conductivity along the line or surface of such record, means are provided for passing an electric current transversely through such recording surface at successive points therein, longitudinally of such record, and thereby opposing to such electric current varying resistances by varying the lengths of the path traversed by such electric current through a resisting medium exactly according with such record.

554,884. Manually Controlled Electric Block Signal System. Arthur G. Leonard, New York, N. Y. Application filed July 26, 1894.

A rocking spindle and a locking device are under the control of the spindle for locking and releasing the single operating lever, and there are a gravity dog in position to lock and release the spindle, an electro-magnet for lifting the gravity dog, a catch for holding the dog elevated, an arm on the rocking spindle in position to release the catch and permit the dog to fall, and means for energizing the electro-magnet from a distance.

554,889. Fire Alarm Telegraph System. Jacob F. Mehren, Chicago, Ill. Application filed April 4, 1894.



NO. 554,862.

In a signaling system having two independent main lines, over each of which every signal is transmitted successively, first over the one and then over the other line the combination is claimed with two signal receiving instruments, each connected in one of the main lines and respectively responsive to the successively transmitted signal, of an alarming device normally operative by one of the receiving instruments, and controllably connected for its operation with the other receiving instrument.

554,868. Electrically Operated Railway Track Switch. Frank H. Harriman, Hartford, Conn. Application filed December 11, 1895.

One claim is for the reversible trolley pole, the shafts carried thereon, the pinion, the gear sector connected to crank arm and crank pin, and the slotted crank arm carried on shaft.

554,895. Telephone. William H. Russell, New City, and George E. Russell, Little Falls, N. Y. Application filed August 10, 1895.

In this device there are a telephone having a casing, a vibrator diaphragm, a composite carbon element, a cylinder inclosing the carbon elements, a bar magnet rigidly connecting and supporting the diaphragm, cylinder and contained carbon, and a coil or winding on the bar magnet, a generator, an inductorium, a primary circuit including the generator, the carbon and the primary winding of the inductorium, and a secondary circuit including the secondary winding of the inductorium, the winding and the line.

554,896. Key Socket for Incandescent Lamps. Benjamin W. Snow, Syracuse, N. Y. Application filed January 2, 1895.

The claim is here presented: In a device of the class described, the combination of an insulative base, an insulative stop supported thereon, a terminal secured to the base, a second terminal secured to the stop, a revoluble key journaled intermediate of the base and stop, and provided with an angular block having pressure surfaces, each provided with a groove transverse the direction of revolution of said block and a contact-spring having one extremity secured to the stop and in electrical connection with the second terminal, said spring extending freely over and round three sides of the block in the path and plane of the path thereof, whereby the spring may be depressed and caused to make a rearward sliding contact with the first terminal when operated upon by the block, and may then return slightly and rise into a groove of the block to retain the latter in its operative position.

554,910. Electric Heater, Resistance or Rheostat. Patrick B. Delany, South Orange, N. J. Application filed June 7, 1892.

The first claim is for an electric heater or resistance, consisting of a conductor or conductors having fireproof insulating buttons strung thereon in contact and constituting a continuous flexible insulation embedded or inclosed in a mass or block of refractory insulating material.

554,914. Ore Concentrator. Joseph O. Dimmick and Edward K. Woods, Denver, Colo. Application filed April 27, 1895.

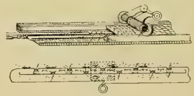
In an ore concentrator, a pair of inclined tables, each comprising a metal bed plate, a bed of insulating material over the metal bed, and rows of metallic pins extending from the metal bed through the bed of insulating material, and an electro-magnet having one pole connected to the metal bed plate of one table and the other pole to the metal bed plate of the other table.

554,918. Electric Circuit Closer and Breaker. John R. Farmer, St. Louis, Mo. Application filed May 25, 1894.

Claim one is as follows: In a circuit closer, the combination of the electro-magnet having an armature connected to the controlling circuit, and a pivoted operating arm extending down into working relation with the trolley and terminating above its pivot in a cam end arranged to bear against the armature and force it into position for closing the circuit.

554,926. Actuating Mechanism for Advertising Devices. Manly M. Gillam, New York, N. Y. Application filed October 15, 1895.

The combination is claimed of a rotatable sign, a shaft carried by the sign, a disk secured to the shaft, an electro-magnet, an armature therefor, a circuit making and breaking device for energizing and de-energizing the magnet, consisting of a flexible contact strip and a lever arm traversing the same carried by the armature, and mechanism controlled by the lever arm for rotating the disk.



NO. 554,962.

554,949. Rail Bond for Electric Railways. Subbo Nikoloff, Worcester, Mass. Application filed January 2, 1896.

The attaching device or plug for electric rail bonds is described, comprising an outer cylinder joined at one end with an inner cylinder axially concentric and parallel therewith, and having an annular intervening space for the reception of a tubular key or expander.

554,955. Insulator for Electric Wires. Magin Riera, Havana, Cuba. Application filed September 5, 1895.

Two clamp members are employed, one L-shaped and the other of inverted L-shape, so as to inclose between them a substantially prismatical space. An elastic filling is held in the space and apertured for the reception of the wire.

554,962. Electro magnetic Induction System of Propulsion. Alpheus C. Shuttleworth, Philadelphia, Pa. Application filed February 7, 1895.

The feature of the invention is embodied in the following claim. In a system of distribution of electrical energy for railways, the combination with sections of laminated iron ties, of a single insulated primary conductor wound around and at right angles above and below the sections of laminated ties in a series of single convolutions or spirals, said laminated ties forming stationary parts of a magnetic circuit, a movable part of the magnetic circuit, a secondary electric circuit encircling the movable part of the magnetic circuit, and automatic switches for producing a multiple or parallel arrangement of the upper and lower sections of the primary conductor when said switches are in their normal positions.

555,051. Telephone Instrument. Harry P. Pratt and Henry A. Allen, Chicago, Ill. Application filed February 19, 1895.

The instrument comprises the bent magnet, having an annular pole piece on one end, and a pole piece provided with a helix and arranged at its opposite end, and the diaphragm provided with an armature arranged to extend through the space within the annular pole piece.

555,056. Galvanic Battery. Eason L. Slocum, Pawtucket, R. I. Application filed July 2, 1894.

The jar is provided at its bottom with a well for the quicksilver, and the insulator is provided with a perforation over the well, whereby the well may be filled with quicksilver without disturbing the parts of the battery.

555,057. Electric Lighting System. Eason L. Slocum, Pawtucket, R. I. Application filed April 3, 1893.

The combination is claimed of electric batteries arranged for connection with a lamp circuit, and separate electrical connections with the negative pole of each of the several batteries, which connections do not extend to the positive electrodes of the batteries, with an automatic commutator adapted to distribute the electric current through the separate connections to a plurality of the batteries, and to effect the disengagement of one of the plurality of engaged batteries for recuperative rest, and the engagement of a recuperated battery in its stead, and the hand switch for directing the electric current to the lamps.

555,058. Galvanic Battery. Eason L. Slocum, Pawtucket, R. I. Application filed March 28, 1893.

The carbon electrode, provided with the flange which rests upon the top of the jaw, the recess formed at one side to receive the zinc electrode, the central cavity, the side openings, and the longitudinal interior grooves.

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## Electric Light Plant at Chamberlain, S. D., Operated by Artesian Well Power.

Brule county appears to be located in the heart of that district of subterranean water courses known as the artesian well basin of South Dakota. This basin is said to embrace over 20,000 square miles in the central portion of the state. Throughout this region it seems only necessary to bore into the earth to a certain depth, varying in different places, but said to average about 1,000 feet, to obtain a constantly flowing supply of water at the surface averaging about 1,000 gallons per minute for each well. To convey an idea of this amount of water, it may be stated that a well flowing 800 gallons per minute will cover a section of land containing 640 acres one inch deep every 15 days, or more than two feet in one year. The soil of this district is fertile, and only a steady supply of moisture is needed to insure abundant crops. Nature's bounty appears to have provided a certain means of irrigation from subterranean streams, and so the question of locating artesian wells is exciting great attention throughout the state, and is accepted as one of the principal factors in the future prosperity of South Dakota. It is only within a year or so that the people realized the undeveloped resources beneath their feet, but there are now over 30 artesian wells in Brule county alone, estimated to flow 70,000,000 gallons every 24 hours. The water shows a uniform temperature of between 60 and 70 degrees, and, flowing in such a large amount and with such force, no difficulty has been experienced from freezing in the severest weather.

So far these artesian wells have been considered valuable principally for irrigation, but they have also been used to a limited extent for power, and the largest of all, the "gusher" recently completed in Chamberlain, the county seat of Brule county, is of especial interest, as it supplies the power for driving the electric lighting plant of the town. The Chamberlain Electric Lighting company is the undoubted possessor of the unique distinction of having the only electrical plant in the country driven by artesian well power.

As may be judged by the photographs herewith reproduced, the company does not at present conduct its operations on an ambitious scale. Its power house is a small frame building, which has just been moved to the new location at the well and is being remodeled into a more presentable and commodious station; it has one 500 light dynamo. Should the bright anticipations of greatly increased material prosperity in Brule county, owing to the possibilities of the artesian wells, be realized, however, the population of Chamberlain, at present about 2,000, will be rapidly increased, and a much larger plant will be necessary. Indeed, the installation of a larger dynamo is now contemplated, as the entire current capacity of the present machine is engaged. The officers of the company are: President, G. W. Pitts; vice-president, W. L. Montgomery; secretary, C. D. Tidrick; treasurer, J. W. Warnshuis.

The well of the Chamberlain Electric Lighting company is said to be the largest artesian well in the United States controlled for power purposes. It is about 50 feet from the power house, shown in Fig. 1, and its uncontrolled force is shown in Figs. 2 and 3. The well is 675 feet deep and eight inches in diameter. It is composed of sections of eight-inch iron pipe, inside of which is 60 feet of six-inch slotted pipe at the bottom, to prevent the ingress of rocks or other large substances with the flow of water. For a depth of 470 feet from the surface the main pipe is encased in 10-inch iron pipe to strengthen it and prevent possible leakage. Both sizes of pipe are firmly seated on layers of granite. Three or four strata of this rock, from four to eight feet thick, of exceptional hardness, were encountered in putting down the well. This granite was the most obdurate that had thus far been encountered in the well region, and it required from two to three weeks' drilling, day and night, in each case to get through five or six feet of it. This work was done with the artesian well rig owned by the Bank of Iowa & Dakota and D. N. Kaufman of Chamberlain, and was superintended by Mr. Kaufman. When the vein of water was struck, however, the patient labor was amply rewarded, as may be judged by the pictures on pages 110 and 111. The entire body of the eight-inch flow goes up 12½ feet from the mouth of the well, as shown in Fig. 2, while, if reduced to a 2¾ inch stream by a nozzle, the water shoots up to a height of 162 feet (Fig. 3). Tests show that the flow is 4,430 gallons per minute at a pressure of 110 pounds to the square inch, and it is computed that the effective energy of the moving water is equal to 100 horse power constantly exerted. The well is located on the bank of a creek which flows through the city, emptying into the Missouri river. Usually the creek is dry at this season of the year, but now, with the water from the new well flowing into it, after operating the plant, the former creek is a fair-sized stream.

Water Wheel, Main Shaft and Driving Pulley. Inlet Pipe, Power House and Tail Race. Alternator and Exciter.

FIG. 1. ELECTRIC LIGHT PLANT AT CHAMBERLAIN, S. D., OPERATED BY ARTESIAN WELL POWER.—STATION BUILDING AND DETAILS OF MACHINERY.

The mechanical means employed to utilize and control the power are simple but effective. An eight-inch L was attached to the top of the casing of the well and 50 feet of horizontally placed eight-inch pipe conveys the water from this connection to the power house. Here the volume of water is reduced to a stream about three inches in diameter, which impinges on the buckets of a Pelton water wheel. This wheel is mounted on a shaft carrying a large driving pulley, which is directly belted to a 500 light alternator built by the Royal Electric company of Peoria and operating at 1,100 volts. A small exciter is driven from the armature shaft of the large machine. The power is more than sufficient to run the plant to its full capacity, and the 500 lights are all taken in the city.

Regulation is obtained by raising or lowering the nozzle at the wheel, and the power is thrown off entirely by simply lowering the nozzle so that the water will go entirely under the buckets and run unimpeded through the

waste pipe. The spring in the 50 foot pipe leading from the well is sufficient to allow this movement. The secondary circuits of the wiring system are operated at 52 volts, and the lamps are constantly kept up to this pressure without difficulty.

The lights at present are run from sunset until midnight and from 4:30 A. M. until sunrise, and by next fall the company expects to have the residences of the city take enough light to warrant all-night running. At present much of the power is going to waste, and steps are being taken to put it to use by running other manufacturing plants, and thus utilizing the full force of the well night and day. The location of Chamberlain on the edge of one of the greatest cattle and sheep ranges in the United States makes it an exceptionally favorable point for establishing a creamery, tannery, wool-cleaning establishment, cheese factory or woolen mill, any of which, or all, could be operated by this power. The business men of the city are taking an active interest in the creamery project and endeavoring to secure and interest some first-class creamery man to locate in the city. A guarantee of 1,000 cows can be secured without any difficulty in the vicinity of Chamberlain, and

FIG. 2. ELECTRIC LIGHT PLANT AT CHAMBERLAIN, S. D., OPERATED BY ARTESIAN WELL POWER. EIGHT-INCH FLOW.

sub-stations can be established across the Missouri river and in the towns east of the city, as well as north and south. The well-power is especially well adapted for creameries on account of the steadiness with which it would run the separators.

In Fig. 1 the upper view shows the power house, with the pipe from the well and the waste water flowing into the creek. The picture at the left shows the Felton wheel, shaft and driving pulley, while the dynamo-room is shown on the right.

## Salvioni's Cryptoscope.

A press dispatch from the City of Mexico, February 27th, says that a Mexican scientist in the state of Tobasco several years ago published a claim to an invention similar to that of Professor Röntgen, but more like the discovery of Professor Salvioni of Italy, which is a means of utilizing certain rays of light to see into and through opaque bodies. The Mexican claims to have an instrument enabling him to see the circulation of sap in trees and blood in the human body. Professor Salvioni's invention has received considerable attention in European scientific circles. The instrument consists of a cylinder of cardboard, the inner surface of which is coated with a material that becomes fluorescent under the action of the Röntgen rays. The lens is at one end of the cylinder. The object to be examined with its coverings is placed between a Crookes tube and the cylinder; on looking into the tube through the lens the observer sees the outline or shadow of the concealed object, which is thrown on the fluorescent interior. The device is still crude, but the inventor expects soon to perfect it. He calls it the cryptoscope.

## Novel Use of X-rays in a Chicago Hospital.

Probably the most important application of X-rays to surgery was that made in a Chicago hospital on Friday of last week. It was an experiment and proved successful, much to the satisfaction of the doctors directly interested, and the result will probably excite as much interest in the profession generally. The surgical operation was performed at Mercy Hospital by Professor Christian Fenger, assisted by Drs. James Burry, J. S. Rankin, J. L. Miller and J. B. Murphy. The result of the operation showed that the ray furnishes a method of diagnosing the presence of malignant diseases in the interior of bones hitherto unknown to medical science. A brief history of this case will not be uninteresting. On June 11, 1895, the subject was admitted to Mercy Hospital for what is known as sarcoma, in this case affecting the kidney. Sarcoma is a malignant growth or tumor of a cancerous nature. On June 25th Professor Fenger removed the right kidney. The patient left the hospital on September 17th, apparently cured. On February 6th last she returned, complaining of a pain in the bone of the right thigh. It appears that sarcoma frequently makes its appearance in portions of the body remote from the primary seat of trouble, being carried from one part to the other by the blood.

On February 24th Dr. Burry and C. E. Scribner took a sciagraph of the woman's thigh, the ray passing through to the hollow in the thigh bone containing the marrow. It showed that a portion of the bone midway between the knee and the hip joint two inches long and an inch wide was entirely gone and its place was filled up by a spongy growth. The diseased condition was so apparent in the picture that Mr. Scribner, without medical education, accurately described its existence and form. The operation showed that sarcoma had attacked the thigh bone in its interior and had produced, in size and shape, a condition exactly corroborated by the picture.

The importance of the operation lies in the fact that it demonstrates that the X-ray furnishes a new means of diagnosing not only sarcoma but other diseases of the bones, the presence of which, with the means hitherto available to medical science, have often been so obscured that the knowledge of the existence of a malignant disease has been so deferred as to make it impossible to avert fatal results. This is the first known instance of the use of the ray in such deep-seated structures.

## Further Experiments with Röntgen Rays.

By W. M. Stine.

The experiments noted in the last issue of the Western Electrician have been continued, and some of the results possess sufficient interest to be noted, since they afford some additional light on the nature of the Röntgen rays. The yellowish-green fluorescence of the working Crookes tube was thought by Röntgen to be the secondary source of the rays. The fluorescence is due to uranium present in the glass.

Does the molecule containing uranium, vibrating with light frequency, directly generate the ray?

To investigate this, a pair of carbons was soaked in a solution of uranium nitrate, and, after drying, were burned in an arc lamp, and a plate exposed to them for two hours. A flash-light powder was made, containing uranium nitrate, and several large charges of this were fired near a properly-prepared plate. A large cube of uranium glass was obtained, and excited by focused rays from an arc lamp. The fluorescence was singularly vivid. Plates were exposed to light both transmitted and reflected by the cube. In all the cases cited not the faintest trace of a sciagraph was seen. It is thus shown that this particular fluorescence does not generate the Röntgen rays. However, in the active tube this fluorescence is supposedly associated with a static charge of negative electricity. The cube was again excited by an arc lamp as above, being kept superficially charged with negative electricity by a static machine, while suitably prepared plates were exposed near it. As before, not the slightest effect was obtained. The reputed success of tubes with walls partly of aluminum indicate that the chief source of the rays is either the cathode or the charged molecules in transit. However, we seem to have obtained unmistakable evidence that the fluorescent end of the bulb likewise generates the rays. If a piece of metal is supported a short distance from the dry plate as a nail driven into a block of wood, a marked penumbra results, while with the object in close contact with the plate the outlines are very sharp. If the rays proceed only from within the tube, whether the plate is placed near or remote from it should not have any influence on the edges of the shadow. If the flourescent glass also generates the rays, the penumbra, in case the object is somewhat separated from the plate, should be narrow when the plate is at a distance of say 10 inches, while at an interval of an inch or two the penumbra should be proportionately broad. We have repeatedly and decidedly demonstrated the latter case does occur. The rumor that the penumbra is due to refraction we have clearly proven to be without support. These observations on the fluorescent uranium molecules accompanied by a static discharge seem to support the explanation previously suggested, that the sciagraphs are produced by electrolysis in conjunction with longitudinal waves.

We have also tested the effect of flame on the absorption of Röntgen rays. A Bunsen burner was so adjusted that the upper part of the flame was brightly luminous. This was interposed between the tube and a dry plate during an exposure of one hour. On development, no shadow of either portion of the flame was to be observed.

The hypothesis that the sciagraph is due to a species of electrolysis more fully explains the evidence we are accumulating than any other so far advanced. The X-rays undoubtedly move radially in straight lines, and when they proceed from a molecule bearing a negative charge the lines of induction probably coincide in the direction of the longitudinal waves. Wherever a molecule is vibrating in the ether, be it with the period of light or heat, longitudinal waves of a same period are induced. Such rays alone cannot affect a dry plate, neither can inductive lines of force at rest decompose the silver salts on the plate. This explains why sciagraphs are not obtained with exposure to ordinary light sources, or to static or slowly alternating electrical charges in air. On the other hand, this hypothesis indicates that the X-rays should be generated within the Geissler as well as in the Crookes tube. A number of experimenters have independently discovered that the X-rays neutralize static charges, either of a positive or negative character, the energy being probably immediately transformed into molecular heat. Accordingly, if the pressure of gas within the tube be such that the charged molecules are present in sufficient num-

bers, the rays will be absorbed by them and not escape without the bulb. It would be too tedious to indicate the many ways in which our experimenis confirm this view, but suffice it to state they strongly corroborate it, so that we are able with precision to indicate whether a tube will be successful or not by watching it under excitation

The writer is under obligation to a number of experimenters who have brought their tubes to his laboratories to be tested, thus affording him opportunity to observe and test the action of a large number and variety of Crookes tubes.

Close observation of successful tubes shows such possess a decidedly green fluorescence, while inactive tubes are decidedly yellow; at the same time the fluorescence

FIG. 3 ELECTRIC LIGHT PLANT AT CHAMBERLAIN, S. D., OPERATED BY ARTESIAN WELL POWER.—TWO AND ONE-QUARTER INCH FLOW.

is also brighter. It is questionable if a tube is at all active when its fluorescence is brilliant. The successful tube also shows a more even illumination of the end of the bulb. The inactive tube differs in this respect: a marked cathode shadow is perceptible, which shifts in position almost constantly, the edges of the shadow being irregular, exhibiting a curious phenomenon, looking like evaporation. This may be due to ray absorption. The active tube rarely shows any purple cathode or whiter anode light, and as this decreases, if present at all, the tube grows more active. It must be borne in mind that a tube may pass from the active to inactive condition, but such tubes cannot be relied upon to produce good results at any time.

We have also found that in every case a tube increases in efficiency with use, and the purple light grows fainter. No tube as yet has been very efficient on first trial. If a tube be worked continuously throughout the day, its efficiency is markedly increased, but if it be allowed to stand for some days it has been found that its activity is lessened. These facts would seem to indicate that the metal electrodes occlude or absorb a portion of the contained gas, thus materially increasing the vacuum. At the same time another portion of the gas may have been absorbed by the superficial layers of the glass, owing to the strong condenser action between charges on both the exterior and interior walls of the tube. Sparks may often be drawn from the exterior of excited bulbs. Tests have been made upon a large variety of Crookes tubes with varying success. One type, however, has proven invariably successful; that is, the shadow tube containing the maltese cross. The reason is apparent: such tubes possess an extremely high vacuum. A suggestion might be made to those who are making tubes to use a large disk for the anode to increase the amount of occluded gas, also that both electrodes be made flat, since concave electrodes produce injurious local heating.

## Application of X-rays for Exhibiting Invisible Objects in Motion.

By Edward P. Thompson, M. E.

Dr. McKay of the Packer Institute of Brooklyn, New York, tested the idea of exposing upon a fluorescent screen the shadows of invisible objects in motion. We saw in what is conveniently termed a kinetoskotoscope, the motion of the bones of the fingers when bent back and forward, the shadow of the rest of the finger being faint. The result was so successful that I noticed a curious feature which was not known to me before, and that is that the bones appear on a side view to be at the back of the finger, and very thin, measured from the back to the front. There is a reason for this, I suppose, in that the inner side of the finger should be more like a cushion, so as to be better able to handle objects. An experiment was also performed consisting in opening and closing a pair of pincers which were absolutely invisible to the eye, but the shadow of the moving parts was clearly visible upon the screen. A chain was shaken back and forth, and the separate links moving relatively to each other were clearly visible. These experiments would prove that with the present condition of the X-rays the skeleton of a fish could be seen to move backward and forward in the act of swimming, as well as the skeletons of all small objects while in motion and performing the functions of life. I think that some of the best objects to be looked at while in motion would be, for instance, a bird, through which the rays would so easily pass, except as to the skeleton. All youthful forms of life could be examined, very probably, by this means, and the motions exhibited. I have for two or three weeks been trying different kinds of experiments, and I find that certain precautions are necessary in order to obtain the best results. In the first place, it is necessary, very probably, to show just how I made a fluorescent screen, because I find that others have tried to make it by crystallizing the chemical barium platinocyanide from a solution upon a sheet of paper. Others merely pressed the crystals upon a surface like filter paper. Such screens are of little value, especially as the substance then fluoresces blue, which is nearly invisible, and only so in spots. By the following means the results are excellent and the screen is so luminous that the shadows are clearer than in the X-ray photographs. The cyanide should be powdered to the finest dust possible. Then some of the clearest colorless varnish should be put upon a piece of tracing cloth, because the same is so strong and so transparent to the fluorescent light which is produced. The powder may now be mixed very thoroughly and intimately with the varnish, so as to make a homogeneous mass, in quantity sufficient to spread over the cloth to a thickness of about one-eighth of an inch. This is mentioned because experimenters are likely to make the layer too thin. The reason for powdering the material is to produce a maximum amount of reflecting surface. The object of the varnish is to hold it together, and yet to permit the reflected rays of fluorescent light to become visible. The varnish should then be dried, but not necessarily perfectly dried. These directions should be followed very closely for good results. The end of the tube which is directed toward the Crookes' tube, and which contains the screen, should be covered with photographers' black paper, used for wrapping up sensitive plates. Either side of the screen may be directed toward the Crookes' tube. A very important precaution is to perform the experiments in a rather dark room. It may be light enough to be able to see objects, but if the room is very light the eyes are not used to darkness, and therefore the experiments are not satisfactory; but if the room is quite dark, the screen in the closed tube appears immediately upon setting the eye to the hole in the tube to be perfectly luminous. It will be more luminous under these precautions than luminous paint which has been held in the sunlight and brought into a dark room, and yet if performed where the eyes are exposed to daylight the experiments are not so satisfactory. Another precaution is to have the electrical apparatus so arranged that the phosphorescent light from the Crookes' tube is steady, which may be done, of course, by means of Leyden jars or other condensers. My idea of this new use for the X-rays was conceived and attested on February 1st.

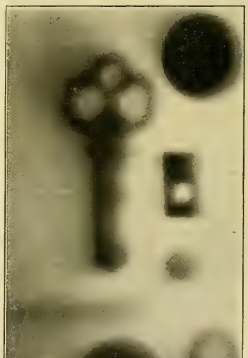
## Röntgen Photography.

By H. S. Carhart

So much has been written about the new photographic process that I have not ventured before this to add the results of some trials in my laboratory. The best result which we have obtained was by Professor J. O. Reed on February 10th, a reproduction of the picture being here shown. A key, a coin, a metal tag with a hole in it, and a bit of a hack saw are among the objects on the plate. They were photographed through a slated plate holder, six thicknesses of black cloth and a pine board three-sixteenths inch thick. The time of exposure was 61 minutes

The Crookes tube was placed very near the plate holder and over one edge of it. The position was determined by the form of the tube. The penumbral appearance of one side of the objects is due to the oblique direction of the X-rays on the plate. They traverse different thicknesses of the objects at the near edge because of the direction of the rays. The same effect is noticeable on the remote side of the hole in the steel saw. For the same reason the key appears to cast a shadow on the side away from the tube.

The particular object of this note is to call attention to a point which I have not seen mentioned in any account of the photograpic process that has excited so much interest. Professor Reed observed that after a Crookes tube has been used for about half an hour its resistance appears to be greatly increased, so that it almost ceases to fluoresce, and sparks break over the outside between the electrodes instead of the discharge through the tube. It recovers its sensitiveness after resting about 48 hours. In working with a tube provided with three anodes, I found that after the fluorescence had sensibly diminished with one anode, the transfer of the connecting wire to another anode, leaving the cathode the same, caused the tube to fluoresce as well as at first. The third anode appeared not to work well at any time. If after one anode had become fatigued, the current was reversed, that is, if this anode was made the cathode, the



RÖNTGEN PHOTOGRAPHY

fluorescence was as bright as when the current was first started. No effect appeared to be produced at the cathode, but for some reason unknown to me the anode appeared to fail, so far as fluorescence was concerned. At the same time, the action of the X-rays does not cease when the tube tires out, because we get good impressions only by continuing the process for 20 minutes or more after the fluorescence has almost ceased. This seems to indicate that a tube with an exceedingly high vacuum, such as the Crookes tube appears to have after half an hour's use, would give better results than the ordinary Crookes tube. I have no means of getting such a vacuum now, and cannot get such a tube to try; but I hope to have one soon.

## Sciagraphs and Electrographs.

By W. M. Stine.

The excitement which has followed Professor Röntgen's discovery has been as remarkable as it has been universal. Not only have scientists been set experimenting, but a great number of laymen as well. Bearing, as the matter does, on some of the most abstruse points in physics, few scientists are sufficiently prepared to deal with the matter understandingly, and the laymen

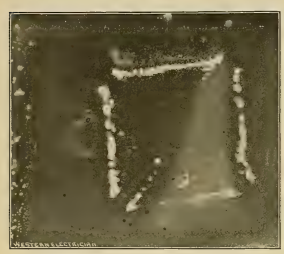


FIG. 1. SCIAGRAPHS AND ELECTROGRAPHS.

must experiment with naught to guide them. Enthusiasm usually overshoots the mark, and when this has been joined with the sensationalism of the daily press, and, to some extent, that of the technical press, as in the present instance, many errors are given wide circulation and credence. Röntgen's discovery is but the climax of many investigations extending over the last 10 or 15 years, and there are so many phases of these phenomena, apparently similar, but in reality radically different, that even the most competent scientists find it difficult not to be misled. With the announcement of Röntgen's discovery two conclusions seem to have been at once accepted—that the sciagraphs were produced by longitudinal vibrations, pure and simple, or by the action of static charges of very high potential. According to the first, longitudinal waves should be produced by all molecules vibrating with light frequencies, so various light sources were industrially experimented upon, and some wonderful results promptly communicated to the press. The second conclusion led to testing the efficiency of metallic plates charged by induction coils, static generators and Leyden jars. Results more numerous and even more surprising than the first noted were given the widest publication. But it is safe to say that all these have not been sciagraphs at all, for it may be said with the greatest confidence that no true sciagraph has been produced by other agency that the electrified Crookes tube. It is

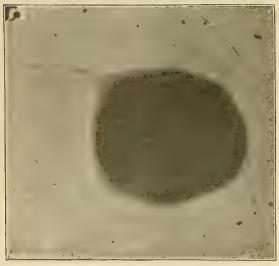


FIG. 3. SCIAGRAPHS AND ELECTROGRAPHS.

not my intention to impugn the honesty of these experimenters, but rather to attempt to explain their results and point out the true conditions for, and characteristics of, the sciagraph and thus with the hope of enabling many experimenters to detect spurious results. Upon analyzing the many reputed sciagraphs taken by these various methods, we find the errors to have been due to two causes: (a) The fogging of the dry plate by weak, diffused light; (b) the action of static electricity on the film of the plate.

A few days since the editor of the Western Electrician kindly referred a number of negatives of supposed sciagraphs for the inspection of the writer. They were accompanied by a description of the methods of making them, and, with due deference to the sender, the report will be quoted *verbatim*. These results will be investigated, not in the spirit of criticism of the negatives themselves, but merely to serve as illustrations in discriminating between true and spurious sciagraphs.

"Plate No. I. (Fig. 4) was obtained by placing a piece of lead upon the photographic plate and covering the plate with several layers of photographic paper. It was then placed upon a board within about 12 inches of the driving belt of the engine, leading to the main shaft to which the dynamos were connected (Edison dynamos). Exposure lasted about 45 minutes.

"Plate No. IV. (Fig. 3) was obtained by means of a common Ward arc lamp, the plate parallel with the carbons and six inches distant from them. The plate was in a plate holder with the shutter closed. The object was a lead maltese cross placed on the outside of the plate holder. [Time of exposure not stated.]

"Plate II. (Fig. 1) was obtained in a manner similar to Plate I. The same lead cross was used, placed directly on the dry plate. A device was used to prevent sparks passing to the plate.

"Plate V. (Fig. 2). The same object and method as in the case of Plate II."

Waiving the conclusions of the experimenters, it may be pointed out that Figs. 1, 2 and 4 are true electrographs and Fig. 3 a result due to probable leakage of light on the plate. The last negative is a singular one, the clear portion appearing as if it had not been due to a shadow, but had rather been caused by some foreign matter on the plate while this was in development.

The latest sensation has been an alleged sciagraph

FIG. 5. SCIAGRAGRAPHS AND ELECTROGRAPHS.

made by a permanent magnet. This was placed on a protected (?) plate and allowed to remain some hours. Development showed an imperfect outline of the magnet in shadow. What really took place was that light leaked through the imperfect coverings on the plate, the magnet, as an opaque object, shielding the plate underneath. So many fallacies are constantly arising in connection with permanent-magnets that it is well to point out that such a body can impart *no energy*. The effect on a dry plate requires the expenditure of a definite though minute quantity of energy. If such a result were possible, the picture would be of the lines of forces rather than an equally clouded plate. We have already noted testing the arc light and sunlight as well, with no result whatever on a properly covered plate.

The effects noted in Figs. 1, 2 and 4 are electrographic, pure and simple. In Figs. 1 and 4 the peculiar brush-like creeping of the static charge is clearly seen. While Fig. 2 shows the object in partial shadow (it must be noted the description applies to the negatives, while the cuts show the effect with the lighting reversed), yet the black dots are here present which show so distinctly in Figs. 1 and 4. In fact, an electrograph may be recognized by such dark spots, as those familiar with the subject well know. Had this been a true sciagraph of the lead cross, the outlines would be more clearly defined, and the spots and irregular cloudiness would be absent.

It may be well here to point out the real distinction in such cases. In general, a sciagraph shows the object in more or less clear shadow on an equally dense background; in the electrograph the object is dark, with perhaps a denser border on a clear background. But some doubts may be occasioned in applying such statements. In Fig. 5 is shown a true sciagraph of an iron washer resting on a covered plate. This is to be distinguished from a negative, due to leaking in of light, by its sharp outlines. However, should the object be at some distance from the plate, a penumbra results, and the negative is not to be distinguished from one of the same object in contact with the plate due to weak light. It thus appears that the only real test for the sciagraph is to employ an object containing parts both opaque and transparent, such as a coin in a purse, a lead pencil, or nails in a strip of wood.

We will now examine the electrograph more fully. The negative shown in Fig. 6 was made by placing the

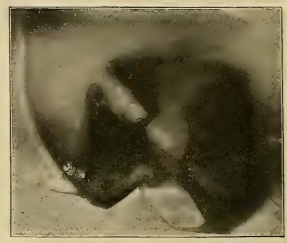


FIG. 2. SCIAGRAPHS AND ELECTROGRAPHS.

poles of the induction coil directly on the plate, the dark tracing being the path of the spark itself. The brush-like positive end is clearly distinguished from the smaller negative. In explanation, this effect on the dry plate is due to electrolysis of the silver salts in the film, and however varied the electrograph may be, the results are always due to this cause. It is not necessary that luminous effects be present in such cases; the electrolysis may be the result of a silent, practically invisible brush discharge, or the electricity may be communicated by the air itself, or act entirely by induction.

While Fig. 7 shows many evidences of the passage of sparks, two remarkably clear shadow effects are noticeable. The objects were coins, and the probable reason for the lack of effects under the coins lay in too great intensity of the charge imparted to them. When the electrification is slow and small in quantity, the metallic object in contact with the plate will be quite accurately reproduced, provided the exposure is long enough. The electrograph shown in Fig. 8 is an instance of this, the spark tracings being almost absent. The face of the dollar illustrates another deceptive case. It might at first be supposed the shadow on the head was due to the greater

FIG. 4. SCIAGRAPHS AND ELECTROGRAPHS.

thickness of the metal at this point, but such conclusion is evidently in error; the smoothness of this surface prevented the streaming off of the charge. The negative reproduced in Fig. 9 is a singularly perfect electrograph. Every detail of the coin is reproduced with surprising sharpness and detail, while the brush discharge surrounding it is very symmetrical. On careful examination

another peculiarity is noticeable; the rim shows in clear shadow, while the other projections are dark. When an electrified conductor is in actual contact with the dry plate, no electrolysis occurs underneath it. This is also liable to lead to an error. This is clearly shown in Fig 10. The object was cut from tin foil and tightly pressed down on the plate. The symmetrical appearance of the brushes and the mutual repulsion of like charges of electricity are very clearly indicated. These electrographs were made in the laboratories of Armour Institute by Messrs. Wilhoit and Manlove, to whose skill the writer is indebted for this singularly beautiful series of negatives. In every case the plate was covered as if taking

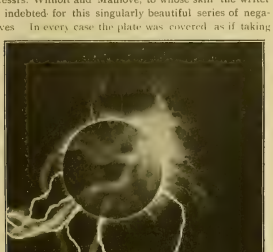


FIG 7. SCIAGRAPHS AND ELECTROGRAPHS.

a sciagraph, the object being electrified positively by means of a projecting pin. In case no direct connection is made to the object, and this be even insulated from the plate, a true electrograph is the result, but the outlines are not usually so distinct.

## Successful X-ray Experiments at the Northwestern University.

Several experiments with the X-ray have been made at Northwestern university at Evanston. The experiments have been made under the direction of O. H. Basquin, instructor in physics, who located a bullet in the hand of H. F. Ward, a senior. This bullet was accidentally lodged in Mr. Ward's hand five years ago and the surgeons at the time were unable to locate it. The first photograph not only plainly showed all the bones in the hand, but also the bullet imbedded between the second and third metacarpal bones. A second photograph was taken with the rays at a different angle, and the exact depth of the bullet below the surface was determined. Mr. Ward says he will now have the bullet removed.

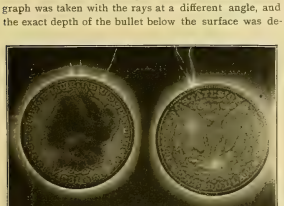


FIG. 8. SCIAGRAPHS AND ELECTROGRAPHS.

## Public Confidence Not Lost.

[From the *Chicago Evening Journal.*]

But the shaking up will do us good. It has shown us that we are, perhaps, inclined to magnify the perils of which we have prated so much, not that they are imaginary by any means, only exaggerated in our arguments. Here we have all of us been praying for a restoration of public confidence when public confidence had never been lost.

## Barrett's "Professional" Reputation.

[From the *Pacific. Electrician*]

Mr. Barrett's paper, the *Electrical Journal*, of Chicago, is praising the Keeley motor. There must, indeed, be "something in it" for Barrett.

The Rockwell City Electric Light & Power company has been granted a franchise for electric lights.

## Give the Public Reasonable Telephone Rates.

[From the *New York Herald.*]

For three years earnest efforts to regulate telephone charges in the interest of the public have been made at Albany, and for three years they have been frustrated in the interest of the companies concerned.

A few days ago the bill for this purpose was introduced in both the Senate and Assembly at Albany, and already a move has been made to shelve it in the Senate. The telephone influence will, as usual, be brought to bear against it. The tender regard which the Republican Legislature for reasons best know to its members has for corporations is a matter of common notoriety. Whether in this particular instance corporate interests or the public interests are to prove paramount with the Legislature remains to be seen.

Telephone companies, like railway corporations, are the creatures of the state and the servants of the people. They derive valuable privileges from the state—the very right of existence and the privilege of doing business. In return for these they assume well defined obligations to the public. Foremost among these is the obligation to give the community an efficient service at reasonable rates. If they fail to do this, it is both the right and the duty of the Legislature to see that the obligation is fulfilled.

That the telephone business has been and is now carried on in this state in violation of the obligations imposed upon the companies is a fact too patent to admit of denial or successful dispute. The rates charged are unnecessarily and inexcusably high. They have widely and loudly been complained of as extortionate, and an aggrieved public has earnestly appealed to the Legislature for relief from the intolerable exactions.

The bill now pending at Albany has been carefully prepared to afford this relief without taking any unfair ad-

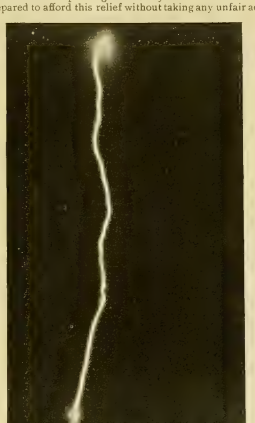


FIG 6. SCIAGRAPHS AND ELECTROGRAPHS.

vantage of the companies or doing them any injustice. It prescribes rates which will relieve the people from extortionate charges and which, it is believed, will prove amply remunerative. The companies are expressly allowed to make 10 per cent. on their capital invested in addition to the interest on their bonded indebtedness, and if they can show that the rates fixed by the law are not sufficient for that purpose provision is made for advancing them.

No one can read the provisions of the bill without being struck with its fairness to the telephone companies and the consideration for their interests shown by its framers. If the public interests and the rights of the community are held paramount to corporate influence and party politics, the bill will be passed at once. We believe that the highest telephone rates in the world are those charged in this city. There is no justice in them, no excuse for them. They amount to an imposition on the public which should not be tolerated, and which an honest, public-spirited Legislature would be quick to remedy.

## Yale Secures a Sciagraph from Röntgen.

An interesting announcement comes from New Haven, Conn., in the form of a press dispatch, which says that "the first picture made by Prof. Röntgen, the German scientist, and sent to this country, has been received at Yale. It was sent to Dr. W. H. Carmalt, of Yale, who has placed it at the disposal of the *Yale Medical Journal*. It will appear in the *Journal* for March. The picture shows an arm which was broken and the fracture reduced improperly. The vicious union of the broken bone is distinctly shown. The principle involved will be used by the professors of the Yale Medical School in their investigation with the X-rays.

## Telephone Companies Common Carriers.

[From the *Chicago Times Herald.*]

Recent court decisions affecting the operation of telephone companies indicate that the time is not far distant when these corporations shall cease to be a law unto themselves. The various state legislatures have enacted laws for the purpose of regulating the telephone business, and nearly every city has a number of ordinances upon its statute books purporting to relieve the people of certain abuses that have grown out of the monopoly. But much of this legislation has not been passed upon

FIG 9. SCIAGRAPHS AND ELECTROGRAPHS.

by the courts, and it is safe to say that the telephone companies have conducted their business with very little regard for anything but their own interests.

A few days ago Judge Carpenter, of the Circuit Court of Michigan, ruled that the Bell Telephone company was subject to the state laws governing common carriers and must extend its service to all persons without distinction who may demand the same, unhampered by unusual or extraordinary conditions, such as contracts fixing time of service or otherwise abridging the full and unrestricted use of its lines for general communication.

This decision was preceded a few days ago by a decision of a Supreme Court justice of the state of New York, who ruled that the telephone companies in that state are subject to the laws controlling common carriers and must obey the orders of courts in all respects the same as other common carriers.

The discovery that telephone companies are "common carriers" and that they are subject to any kind of law is doubtless a revelation to the telephone companies. But if the decision of Judge Carpenter of Michigan is good law, there is no reason why the courts, under the laws

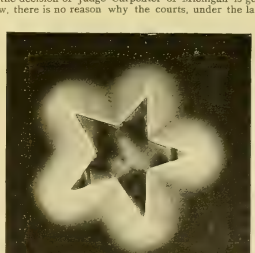


FIG. 10. SCIAGRAPHS AND ELECTROGRAPHS.

regulating common carriers, cannot decide what is a reasonable rate for the use of the instruments.

The mistake which most American cities have made was in granting franchises to telephone companies without imposing certain conditions for the protection of their patrons, such as fixing the rates to be charged for business houses and for dwellings. That such conditions would meet with ready compliance is shown by the action of the city of Toronto, Canada, which had no difficulty in securing acceptance of a conditional franchise, imposing many wise regulations and fixing the rates at less than one-half the charges that obtain in cities of the same class in the United States.

While the telephone companies have been given franchises in this country without restriction, compensation or condition, it is gratifying to know that the courts have begun to "ring off" the monopoly.

A cablegram from Colon, Colombia, states that Senor Marques of Cauca has invented a mode of telegraphing music

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THIS number of the WESTERN ELECTRICIAN is the last to be issued from the old publication offices, 6 Lakeside building, which have been the home of this journal since its establishment in July, 1887. The next number will be sent out from our new offices in the Marquette building. The change is imperatively demanded by the expansion of business and the necessity for better facilities. When the WESTERN ELECTRICIAN was started nearly nine years ago, the business was of course comparatively small, but it has been growing steadily, and although the original quarters were considerably enlarged several years ago, it has once more become necessary to secure more space to accommodate the growing business, especially in the subscription and book departments. It was found, too, that the old location, admirable though it was in many respects, did not possess the facilities demanded at the present time. The new offices present every advantage possessed by the old location and they offer many others as well. The Marquette is unquestionably the finest office building in the city, which is equivalent to saying that it is the best in the country. It is located at the northwest corner of Adams and Dearborn streets, across from the postoffice, and in the very heart of the down-town business district. In construction, equipment and appointment, as well as location, it is a model commercial building. The WESTERN ELECTRICIAN will occupy Suite 510, which comprises the west end of the fifth floor in the Adams street wing of the building. These offices are well lighted and they were arranged for us with the view of meeting the special requirements of this business. They contain 75 per cent. more floor space than our old offices and are vastly superior in every way. On Monday, March 9th, our address will be changed to Suite 510 Marquette building. There our friends will be welcome as of old, and we will always be found ready and willing to assist and encourage deserving enterprise. With improved facilities and in more commodious quarters we hope to advance in every way, constantly raising the standard of our publication, maintaining our position as the representative western periodical, extending our influence in every direction and keeping well in advance of our contemporaries. In this way we hope to retain the confidence and esteem of the trade and enjoy a continuation of the prosperity that has marked the career of this publication from the day of its establishment.

WE commend to the careful consideration of our readers the excellent contribution by Professor Stine upon "Sciagraphs and Electrographs," which appears in this issue. The suggestions contained in the paper will serve as a guide to many experimenters who might otherwise devote valuable time to the making of electrographs while under the impression that they were following the lines of Professor Röntgen's experiments. Professor Stine points out that no true sciagraph has been produced by other agency than the electrified Crookes tube. Pictures made by static discharges and other methods are classed under a general head as electrographs.

ONE result of the phenomenal success of the late government bond sale, and not the least important by any means, is the moral effect upon the community. It has demonstrated the fact that the people have implicit confidence in the government and that there is plenty of capital in the country. It is significant that the issue was oversubscribed six times and that the premiums offered were really phenomenal. With so much unemployed capital, then, why should there be a stringency in the money market? It is the belief of financiers that there will be renewed confidence in trade as a result of this revelation of the country's resources and unemployed capital, that manufacturers will feel more hopeful and that there will be a general feeling of relief from the tension that has been so marked in commercial circles. It is to be hoped that the popular bond sale marked the opening of a new era and that from this time forth there will be no scarcity of capital for legitimate enterprises

IN the issue of the *Electrical Journal* of March 1st is a most disgraceful cartoon, such as might be expected, however, from the vulgar and coarse instinct of the men who are directing that sheet.

This type of blackguardism carries within itself its most effective rejoinder. The one deplorable feature of this business is that professional men who have reputations to lose allow their names to be associated with those of Barrett and Hornsby in the conduct of this scurrilous publication These gentlemen are

Henry S. Carhart,
William A Anthony,
Benjamin F Thomas,
William J Hardman,
Dugald C. Jackson.

Only prompt action can fumigate the garments of these men from the odor of indecency.

Do you, or do you not, gentlemen, stand sponsor for this outrage?

AT the recent annual dinner of the Rochester Chamber of Commerce, John N Beckley, the president of the local street railway company, acted as toastmaster, and one of the principal speakers of the evening, the Hon St. Clair McKelway of Brooklyn, made some remarks about the trolley cars of Rochester. He said that men who started at one terminus of a line and walked got gray-headed before a car overtook them, and that children in arms became voters before the cars on which they were passengers reached the center of the city. There was a time, not long ago, either, when Brooklynites refrained from making any allusion to trolley cars upon festive occasions; and when the subject was discussed it was with bated breath by women and children, while among public men it was all the vogue to decry and denounce the "modern juggernaut." Now, however, it would seem from the good-natured raillery in which the gifted Brooklyn editor indulged that the New York suburbanites are beginning to feel something akin to pride in what is the only really up-to-date feature of their so-called municipality.

WE feel constrained to remind our distinguished friends down East who are now engaged in an undignified controversy over the comparative value of their experimental work and researches in connection with X-ray phenomena that it is rather early to indulge in such unseemly squabble, and, furthermore, we beg to call attention to the fact that there is scarcely any danger that any well founded claims for recognition will be overlooked or disregarded. Such untimely discussion always gives rise to suspicion that those engaged in it are more anxious for their personal aggrandizement than for the advancement of science, and it is almost invariably the rule that the man who is constantly claiming recognition is least entitled to distinction. The small man intellectually quarrels with the rest of the world because he does not receive the credit to which, in his estimation, his work entitles him, and he can see no value in the results obtained by others. But the incident already alluded to has a ludicrous aspect that must appeal to those familiar with the attainments of the gentlemen engaged in the controversy. It is certainly amusing to note the confidence with which a well advertised amateur in electrotherapeutics assumes to dispute one of the ablest and most accomplished gentlemen in the electrical fraternity. We would advise our enthusiastic medical friend to bear in mind that it requires more than such puffery as his newspaper friends may give him to make him an authority in electrical matters. He may be a successful physician and still fail to gain distinction as an electrician; therefore our advice is: Stick to your pills and potions, doctor, at least until such time as you may have acquired sufficient experience and knowledge to entitle you to recognition as an authority on electrical subjects. Then you will probably be able to command attention

THE bill pending in the New Jersey Legislature prohibiting electric railway companies from carrying express packages and freight is an outrageous piece of class legislation; and it seems scarcely possible that the law-making body can so far forget its sense of justice, its duty to the whole people, as to enact this measure into a state statute. If the bill does become a law, the legislators, if honest, will have been swayed by the sophistries of demagogues, for the sole object of the bill is stated by its advocates to be the salvation of the freight and express business of the steam roads, to the end that the employes of the latter may keep their jobs. This is ridiculous. As well might it be argued that publishers should be legally debarred from using typesetting machines because the introduction of the mechanical method throws many compositors out of employment. The argument is fallacious and vicious. In seeking the greatest good for the greatest number, the law-makers have no moral right to arbitrarily oppose the laws of progress that work out the survival of the fittest. If the trolley roads can serve the people better and more cheaply in the carriage of goods parcels, what right has the Legislature to discriminate against them in favor of the steam roads? Such a right does not exist. Both steam and electric railway companies are chartered by the state, and the people have a right to the peculiar excellences of the service of each class If there is a popular demand for electric express service, more men will be needed for it, as the work of men similarly employed on the steam roads is superseded But there is a shrewd suspicion that the alarmed workingman is merely advanced to cover the selfish schemes of the real instigators of the measure—the steam railroad corporations which have suffered by the new competition. It will be a disgrace to New Jersey if the Legislature is bribed or hoodwinked into smothering honest and beneficial enterprise by the passage of Mr Skinner's bill

## Electrical Charge of Storm Clouds.

Albert Nodon recently contributed to *l'Electricien* the results of some researches on this subject, of which the following is a resume:

During a period of stormy days in the month of June I exposed in the open air a metallic disk, perfectly insulated, upon a Mascart base, this latter resting on a block of paraffine. This disk was connected to a Mascart electrometer by a fine copper wire thoroughly insulated

The experiments consisted in measuring the electrical potential of the disk, influenced by the storm clouds during the interval between two disruptive discharges.

One fact sought to be verified was whether this potential varied between discharges, that is, if the value of this potential was influenced by the varying distances at which the disruptions occurred. The following results were obtained:

First—The relative potential shown by the electrometer, during the interval comprised between two successive discharges, in every case reached a maximum which was invariable during the entire storm

Second—The maximum potential shown by the electrometer in the intervals between two discharges was entirely independent of the intervening distance between the point of observation and that of discharge.

From this fact it seems reasonable that the storm cloud forms, as a whole, a mass of sufficient conductivity to be considered as presenting an equipotential surface upon which electrical equilibrium is rapidly re-established after each partial discharge.

Careful obervation of the instrument invariably foretold the precise moment of the coming discharge. At the instant when the maximum potential was reached—which was always the same—the discharge occurred.

## Rowland's Multiplex Printing Telegraph.

From Baltimore comes the news that Prof. Henry A. Rowland, of the Johns Hopkins University, has invented an improved device for sending several telegraphic messages simultaneously over the same wire. When Prof. Rowland gets his patent he will, it is announced, proceed to put his invention into practical use for the benefit of the world. He is reported as making this statement:

The machine I have invented will admit of from five to 10 messages being sent on the same wire at the same time. They do not have to go to the same place. You might start out five messages here at Baltimore over the same wire and one would go to San Francisco, one to Chicago, one to Cincinnati, one to Pittsburg and one to New Orleans. On short lines 10 operators could work, sending 10 separate messages, and they would all be received at the other end without confusion, or any of them might be switched off in another direction at any point along the line. While the wire is full of messages, apparently, an operator at any station along the line could break in and send a message either way without interfering with those which are already being sent. This is something which has hitherto puzzled all who have tried to solve the question. It promises to be a great thing for newspaper offices. They can receive dispatches from all over the country at the same time, and when a long piece of news has the wire from a certain place it will not hinder shorter items being sent from the same place at the same time. This invention will not do away with telegraph operators, but it will enable a number to work on the same line.

Prof. Rowland calls his invention the multiplex printing telegraph. He has one in operation in the physical laboratory of the Johns Hopkins University, and says it works well.

## Financial Returns of Massachusetts Central Stations.

The eleventh annual report of the Board of Gas and Electric Light Commissioners has just been submitted to the Legislature of Massachusetts. The board says:

There are now under the supervision of the board 131 corporations and 12 towns. Of the former 47 are engaged in the supply of gas only, 24 supply both gas and electric light, and 60 supply only electric light. Of the towns two have plants for the supply of both gas and electric light the others supply only electric light.

Official reports relative to action about a municipal plant for gas or electric lighting have been received from 238 towns and cities. Included in this number are all those in which the population exceeds 1,500. Of these municipalities 212 have taken no action during the year 1895.

The cities of Quincy, Taunton and Waltham and the town of West Springfield have considered the subject for the first time. The new plants in Marblehead and Reading have been put in operation during the year.

The following towns have now plants in operation: Braintree, Danvers, Hingham, Hull, Marblehead, Middleborough, Needham, North Attleborough, Peabody, Reading, Wakefield and Wellesley.

Of these, Middleborough and Wakefield only have plants to supply both gas and electric lights. The others supply only electric lights.

The towns of Danvers, Needham and Wellesley have plants for street lighting only; the last two purchase their electricity for this purpose from the Natick Gas & Electric company, and have recently concluded five years' contracts with this company, under which it is to have the exclusive right to supply commercial lights directly to residents of both towns The town of Hingham also buys its electricity from a private company

The following show the aggregate results of the operation of the electric light central stations in the state for the year ending June 30, 1894, and for the year ending June 30, 1895:

| | 1894. | 1895. |
|---|---|---|
| RECEIPTS. | | |
| For light and power | $3,623,056 92 | $3,794,060 41 |
| From other sources | 26,400 20 | 28,135 75 |
| | $3,649,457 12 | $3,822,196 16 |
| EXPENSES. | | |
| For manufacture | $1,389,187 27 | $1,358,689 83 |
| distribution | 491,195 50 | 554,410 25 |
| office expenses and management | 287,646 65 | 295,789 00 |
| taxes | 133,718 27 | 116,601 10 |
| miscellaneous | 151,235 00 | 186,643 43 |
| | $2,452,982 69 | $2,512,133 61 |
| Leaving a balance of | $1,196,474 43 | $1,280,062 55 |
| Of this profit, the gas companies made in their electrical departments. | 184,105 57 | 204,027 52 |
| Leaving for the electric light companies | $1,012,368 86 | $1,076,035 03 |
| To which should be added the income from rents, jobbing, etc., amounting to | 77,677 04 | 151,774 28 |
| Making a total of | $1,090,045 90 | $1,227,809 31 |
| Against which the following charges were made:— | | |
| Interest | $ 302,761 98 | $ 234,144 20 |
| Dividends | 512,836 00 | 487,148 75 |
| Depreciation | 151,388 66 | 565,287 65 |
| Sundry items | 71,783 71 | 123,177 56 |
| | $1,038,770 35 | $1,410,058 16 |
| Leaving a surplus for the year of | $ 51,275 55 | ............ |
| Leaving a deficit for the year of | ............ | $ 182,248 85 |

Six of the companies appear not to have earned expenses, and 33 others have not earned sufficient to warrant the declaration of any dividend.

The gross profits of the companies doing only an electric business have increased over the previous year by $137,763.41, and although interest and dividend charges have decreased, the increased depreciation and miscellaneous charges show a deficit for the year instead of a surplus, as in 1894.

Aggregates from the balance sheets of the electric companies only, taken from the returns of 1894 and 1895, show the following facts:

| | June 30, 1894. | June 30, 1895. |
|---|---|---|
| ASSETS. | | |
| Construction accounts, including patent rights and franchises | $13,792,120 81 | $13,847,615 54 |
| Cash on hand | 216,488 77 | 483,805 68 |
| Due for light and power | 312,873 55 | 318,194 94 |
| Other accounts due | 130,457 72 | 114,594 94 |
| Materials, etc. | 304,309 47 | 266,532 58 |
| Notes receivable | 43,750 64 | 67,956 92 |
| Investments | 228,578 01 | 521,372 40 |
| | $15,028,578 97 | $15,620,073 00 |
| LIABILITIES. | | |
| Capital | $ 8,601,800 00 | $ 9,427,400 00 |
| Bonds | 3,066,000 00 | 3,157,100 00 |
| Notes payable | 1,918,387 83 | 1,817,058 06 |
| Unpaid bills | 442,430 95 | 435,274 97 |
| Unpaid dividends | 37,587 25 | 53,431 50 |
| Interest due and unpaid | 57,111 76 | 54,580 92 |
| Other items | 168,193 83 | 51,363 11 |
| | $14,217,580 37 | $14,996,208 56 |
| Reserved and depreciation funds | 168,193 83 | 180,655 05 |
| | $14,385,774 20 | $15,176,863 61 |
| Surplus | 642,804 77 | 443,209 39 |
| | $15,028,578 97 | $15,620,073 00 |
| Of these companies— | | |
| 45 show an aggregate surplus of | $ 753,152 53 | $ 789,377 19 |
| 16 show an aggregate deficit of | 110,347 76 | 346,167 80 |
| Leaving total net surplus, as shown above | $ 642,804 77 | $ 443,209 39 |
| Which, added to reserves carried as liabilities | 168,193 83 | 180,655 05 |
| Would show an actual surplus of | $ 810,998 60 | $ 623,864 44 |
| Equivalent to per cent. on capital of about | 9.42 | 6.62 |

## National Electric Light Association.

C. O. Baker, Jr., master of transportation, announces that the Trunk Line association has granted a rate of a fare and one-third for the round trip from points in its territory to delegates attending the nineteenth convention of the National Electric Light association, to be held in New York city May 5, 6 and 7, 1896. The convention will be held in a hall most admirably adapted for the purpose in the Industrial building, Forty-third street and Lexington avenue, during the progress of the great electrical exposition.

## Contemplated Use of Electricity in Hydrophobia.

The daily press reports that Lieutenant Nelson H. Boe, after having suffered indescribable agonies for 48 hours, died on February 16th at the Lynn, Mass., hospital of hydrophobia. The application of electricity, which was to have been tried Saturday evening, had to be abandoned owing to the intractability of the patient. Professor Elihu Thomson said that the application would have been purely experimental, as electricity had never to his knowledge been applied in a hydrophobia case. He would venture no opinion as to the probable result

## Electric Lamp Bargain Counters.

The question of the most economical incandescent lamp, cost, consumption, life, efficiency in short, has come to be a matter of no inconsiderable importance. Whether it is better economically to accept a short-lived cheap lamp or a longer lived more expensive one is the two-horned dilemma the ordinary consumer sees presented to him, who knows nothing of economy in current, of efficiency, of watts; in fact, about all the average consumer knows of electric lighting is that he "turns the key, and the light comes on a hairpin in a bottle."

He who would know more is placed in the peculiar predicament suggested as a test for genuine mushrooms: "Eat them. If you live, they were mushrooms; if you die, they were toadstools." Buy the lamps. If they are good time will tell, and if they are not you will find it out; but the maker in the meantime has accomplished his end—sold his merchandise.

The fact is, that the so-called "life of trade," competition, has sandpapered the price of incandescent lamps to a figure at which it is doubtful if a first-class lamp can be sold at a per cent. of profit which is supposed to pertain to electrical merchandise in general—two or three times the cost of manufacture. As a result poor lamps are hawked about the country by smooth-tongued salesmen, who have been known in some instances to divide with janitors and engineers, and even with higher authorities, on introducing their particular make of lamps.

It certainly would seem that some method beside the test of time should be available to the prospective purchaser, to prevent his being duped into the purchase of an inferior "bargain counter" lamp, and it seems as if here were an apportunity for an invention of an economic character, which could be used either by the purchaser to test the goods offered, or the salesman to prove the superiority of his lamps.

In a report on the manufacture of incandescent lamps, made to the associated electrical installation companies of Germany, the results of a great number of experimental tests of numerous lamps were given, with very unsatisfactory results. The report says that the complaints of consumers are well founded and justifiable. These complaints were mainly based on want of care in the manufacture of the lamps, want of uniformity in resistance, and short life.

In a total of 70 lamps rated as 16 candle power, from eight different makers, claimed to consume not more than 3.25 to 3.50 watts per candle, the tests showed the following results: The luminous power ranged between 7.82 and 22.85 candles, and the specific consumption of current from 2.8 to 6.3 watts per candle. Makers of the best grades of lamps were not included, as they refused to enter the contest. It would seem from these facts that electricity is gradually working its way to the bargain counter of the department store.

## Killaloe Figures in Electric Transmission.

Those who are familiar with the lines of the amusing song in Irish dialect beginning—

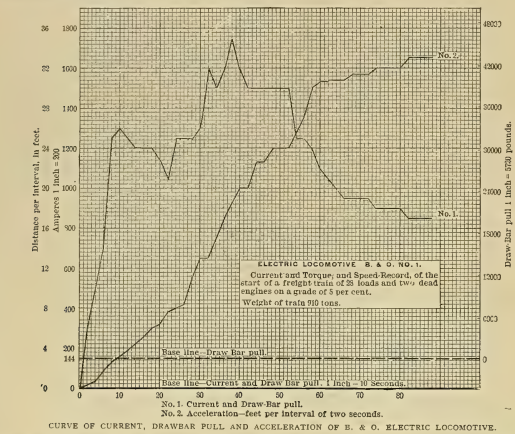
O I happened to be born
At the time they cut the corn,
Quite contajus to the town of Killaloe—

will be interested in the knowledge that Killaloe may benefit in the possible utilization and electrical transmission of the power of the river Shannon. It is stated that an eminent writer, the late Sir Robert Kane, in his famous book, "The Industrial Resources of Ireland," shows with great clearness from actual measurements supplied to him that the average actual horse power available all the year round in the 15 miles of the river from Killaloe to Limerick amounts to 32,950. An English electrical paper points out that great profit could be realized by the electrical utilization of this power.

The great Schuckert searchlight, which attracted so much attention at the World's Fair, where it was mounted on the manufactures building, was purchased by the government to be placed on Fire Island, but Barnegat, N. J., has been chosen instead as its location. The present light at Barnegat is 165 feet above the level of the sea, and it is said that it can be seen under ordinary circumstances at a distance of 19 nautical miles. Important additions have been made to Barnegat lighthouse to prepare it for the new light.

## Curve of Current, Drawbar Pull and Acceleration of B. & O. Electric Locomotive.

The accompanying diagram of a test made by Lee H. Parker of the efficiency of the first great electric tunnel locomotive built for the Baltimore & Ohio Railroad company by the General Electric company fully explains itself. The test was made in September, 1895. To determine the drawbar pull exerted for each ampere of current put into the locomotive, the Pennsylvania Railroad company's dynamometer car was secured and coupled in between the electric locomotive and a train of known weight. The weight of each car in pounds had been accurately determined beforehand. The regular two-mile haul up grade was then made. When the train was in the tunnel on the grade the pull was uniform, as was shown in the diagrams taken on the dynamometer car.

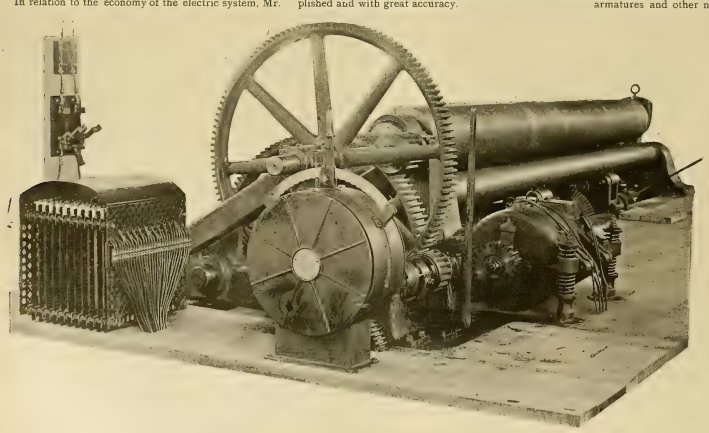



CURVE OF CURRENT, DRAWBAR PULL AND ACCELERATION OF B. & O. ELECTRIC LOCOMOTIVE.

In relation to the economy of the electric system, Mr. Parker gives figures for last October showing that the actual operating expenses of the electric locomotives for that particular month are about the same as for the freight locomotives on the steam railroad, *i. e.*, 23 cents per engine mile. The service of the electric locomotives at that time was only about one third that which it is expected they will have to do when the passenger service is taken up and the line extended the full distance.

## Bending Rolls Operated by Card Electric Motor.

The accompanying illustration shows a 30 horse power series reversible motor, controller and rheostat attached to bending rolls capable of bending iron plates 20 inches long by one-fourth of an inch or more in thickness. The electrical apparatus illustrated in connection with the bending rolls was manufactured by the Card Electric company, Mansfield, Ohio.



BENDING ROLLS OPERATED BY CARD ELECTRIC MOTOR.

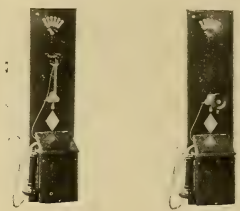
The motor is of 30 horse power capacity at a speed of 325 revolutions per minute under full load. It is geared directly to a shaft carrying a clutch which is operated by a vertical lever which engages in two trains of gearing, as desired, one for revolving the two lower rolls and the other for raising and lowering the upper one. As the motor is reversible, the manipulation of the rolls for bending plates on any circle is easily and quickly accomplished and with great accuracy.

The rheostat is made up of iron wire in an improved form and has a capacity to carry the full current of the motor under all loads and at any speed. The resistance is sufficient to permit reversing the motor at full speed and under all conditions.

The controller is particularly adapted and arranged for series wound motors where close regulation of speed, sudden stops and quick reversals of motor are required. All the working parts are made amply large on account of the severe work necessarily required of such apparatus. The circuit is opened at 24 contacts, breaking in unison, reducing the spark to practically nothing. Twenty-nine contacts are provided for regulating the speed. By means of this construction any desired speed can be had and maintained. The resistance is subdivided and the contacts so arranged for cutting portions of it in or out that arcing over and blistering the contacts is impossible.

## Gustafson Telephone System.

The new telephones manufactured by W. A. Gustafson, Joliet, Ill., are specially constructed for private lines, business houses, hotels, hospitals, factories, etc. They will work on lines 25 miles long with entire satisfaction. A switch at the top of the backboard is used for inter-communication; for long lines lightning arresters are also provided. The transmitter is said to be of an entirely new type, guaranteed for satisfactory performance; it will last a lifetime without getting out of adjustment. Fig. 1 represents the transmitter folded up to backboard when not in use. Fig. 2 shows transmitter pulled down ready for use. The articulation is so loud that it can be heard in the noisiest places. The calling is simply done by pushing a button. Every telephone is numbered and fully guaranteed as to quality and infringement on other patents.



FIGS. 1 AND 2. GUSTAFSON TELEPHONE SYSTEM.

## Arc Dynamos with Iron-clad Armatures.

The Western Electric company has designed and put in service a complete line of arc machines having iron-clad armatures and other new features. It is claimed that these iron-clad armatures have been in use in increasing numbers for more than a year without the loss of a single coil. This is a practical demonstration of the possibility of insulating an iron-clad armature for high voltages. The man who has spent twice as much time in replacing the bands on a burned out armature as he has in rewinding a burnt coil will appreciate the advantage of having an armature in which the knocking out of a wedge gives complete access to a coil.

The general form of construction of these machines is shown in Fig. 1. The bearing bracket is bored out at the same time as the pole pieces, so that the removal of the armature is a very simple matter. The bolt can be taken out and the bearing turned around the shaft until the foot is clear of its seat, and the armature will then rest in the pole pieces, and the bearing can be slid off with very slight exertion.

The simple fact that the armature may be so easily and quickly removed for examination or repairs is a point that is fully appreciated by all central station managers. The bearing may be removed in about five minutes, the pulley in three and the commutator in 10. It may be remarked here that the time occupied by one man and helper in winding an armature coil is, on the average, 50 minutes for an 80 light machine, which may be considered

average size. The details of construction are shown very clearly in Fig. 2.

The armature is built up of very thin sheet-iron rings mounted on a brass spider. The sheet-iron rings have teeth similar to those in the standard incandescent iron-clad armature; the coils are wound in the slots between the teeth and are firmly held in place by wooden wedges between coils, and the voltage between segments of the commutator is so low that it is difficult to flash the machines under ordinary running conditions, and if flashing does occur, the effect on the commutator is scarcely noticeable. By dividing the winding into a large number of small ventilated coils the accumulation of heat in the center of the coils is avoided, thereby preventing the lapped to avoid any chance of puncturing at the joints. The coils on the inside of the armature are wound in insulating troughs somewhat similar to the troughs in the slots, with the exception that they are narrower and deeper. The ends of the coils are insulated from the core, first, by wooden rings, which are placed at the ends of the armature and form rounded corners to wind over, as well as affording additional insulation; second, by built up "U" shaped troughs which overlap and extend in and around the inside and outside troughs, so that the result is that each coil is wound in a separate trough built up of four overlapping troughs, which effectually insulate it from each of the other coils and from the core. A complete trough is shown separate from the armature in Fig. 3.

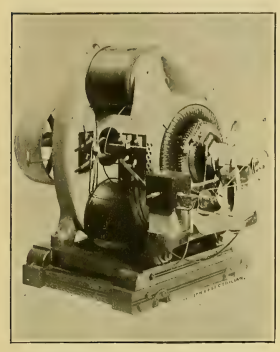


Fig. 1. Iron-clad Arc Dynamo Complete.

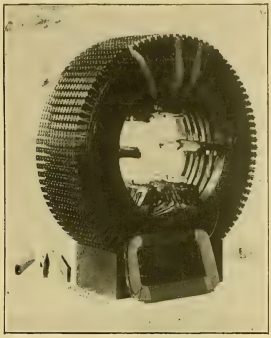


Fig. 3. Armature Core Ready for Winding.

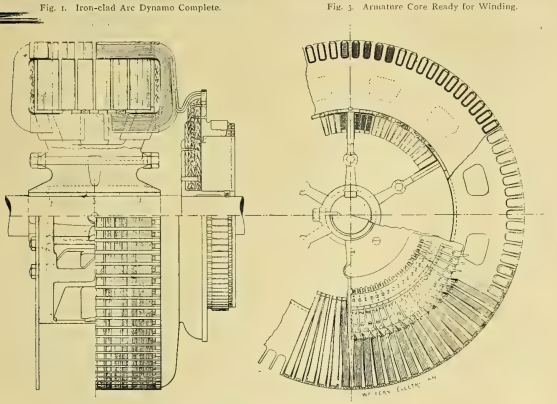


Fig. 2. Details of Construction.

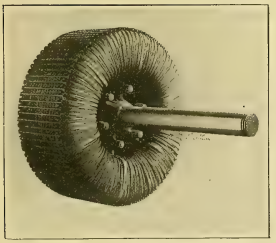


Fig. 4. Armature Complete.—Pulley End.

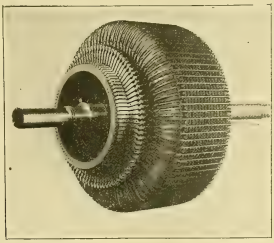


Fig. 5. Armature Complete.—Commutator End.

ARC DYNAMOS WITH IRON-CLAD ARMATURES.

which are driven in over the top of the winding. The armatures are divided into a very large number of coils of comparatively few turns of wire. In this way the voltage in the individual coil is reduced to such a small amount that there is very little strain on the insulation slow roasting of the insulation which occurs in some machines.

The coils are insulated from the core in the slots by a trough which is built up of alternate layers of press board, mica and oil paper, the sheets of mica being well

The advantage of this form of construction is at once evident in case repairs become necessary, as any coil can be rewound without affecting the others in any way, and as there are no bands, all that has to be done is to slip the armature far enough out of the pole pieces to work on it and then take off the commutator and rewind a coil and put the armature and commutator in place again.

In case one or even four or five coils of an armature become injured, it is not necessary to rewind it at once, for if a coil is not short-circuited internally the terminals of the coil can be simply disconnected from the clamp on the commutator and a small jumper put across the same segments to which the coil was previously connected, and the machine can be run with no serious increase of sparking.

If any of the injured coils are short-circuited internally, of course the short-circuit must be gotten out, or the whole coil may be cut out with a cold chisel. If this is done, it is necessary to take out the opposite coil also in order to keep the armature in running balance. A wooden wedge inserted in the place of the inner portion of the coil will serve to hold the other coils in place. The following table shows the result of a test made on an 80 light machine, in which armature coils were cut out at various points:

| Number of coil cut out. | Volts. | Amperes without the use of reducing switches. | Length of Spark. | Location of coils. |
|---|---|---|---|---|
| 2 | 4,300 | 10.4 | ¼ inch | Adjacent. |
| 3 | 4,250 | 11.4 | ¼ inch | " |
| 4 | 4,200 | 12. | ¼ inch | " |
| 8 | 4,000 | 11.4 | ¼ inch | Bunches of 2. |
| 12 | 3,800 | 12.2 | ¼ inch | Bunches of 3. |
| 16 | 3,600 | 10.4 | ¼ inch | 4 bunches of 2 and 8 single coils distributed around the armature. |
| 16 | 3,600 | 13.2 | ¾ inch | Bunches of 4. |

The spark is somewhat increased in length, but is not of a nature to damage the commutator.

The current may be reduced from that shown in the table to the normal amount by the use of the reducing switches, without materially affecting the length of spark, as will be seen from the following test: A five hours' run was made, with 16 coils cut out in four bunches of two and the other eight unequally distributed about the armature. The current was 10 amperes and gave a quarter-inch spark. At the end of the run there was no sign of undue heating and the commutator was not injured in the least.

The all-important factor producing long life in an armature, after good insulation has been secured, is that of ventilation. The many tales of woe originating from the slow roasting of insulation led the designers of these machines to take special precautions to prevent the accumulation of heat in any part of the armature as well as to prevent the general heating. The success of the system of ventilation adopted is shown by a test in which two armatures were built just alike, except that one was wound in the usual way, and in the other the coils were ventilated as shown in the cuts and described below. The former heated 80° F. above the air after a 12 hours' run, while the latter only heated 60° F. after a 24 hours' run.

The armature disks are supported by extensions on the spider. These points of support, which are about two inches wide, are directly over the spider arms, as shown in Fig. 2. Between the spider arms in the open spaces are laid small wooden blocks about one-quarter of an inch thick, which separate the armature coils from the disks, and between every three or four coils on the inside of the armature are ventilating spaces. These ventilating spaces, which are shown very plainly in Fig. 2, open into ventilating chambers in the brass ring which carries the armature disks, and this space communicates directly with the spaces between the iron disks, which are, of course, open at the outside where the iron teeth come between the coils. By this means there is a free

circulation of cool air in through the coils, coming in at the bottom and flowing up through the ventilating spaces between the armature disks and out between the armature teeth. In addition to this, the brass spider arms are partially cut away where they pass through the winding at the bottom, so that there is an additional opening for the admission of fresh air into the spaces between the armature rings. The iron armature rings are held apart in bunches of about 60 by radial strips of asbestos which, from their action as a centrifugal blower, tend to keep the cool air flowing through the armature.

The mechanical superiority of the iron-clad armature over the surface wound is apparent when necessity requires it to be handled, either in placing it in the dynamo or moving it about the station. It may be rolled about the floor without injurious results, as it is absolutely puncture proof.

On the yoke of the machine, shown in Fig. 1, is mounted a pair of reducing switches, which cut out part of the field winding.

The lower switch is for the purpose of adjusting the spark at the brushes to the conditions under which the dynamo is running. When this switch is open the machine will run along without flashing, under normal conditions, though the spark is in this way reduced practically to nothing. If there are sudden and great changes of load, it is desirable to have the machine run with a slightly longer spark, so that it will not flash before the regulator has a chance to compensate for the change in the load; this can be accomplished by simply closing the switch.

The other reducing switch is for the purpose of reducing the current output of the dynamo, so that if it is desired to run the machine part of the time at a lower current than 9.6 amperes this switch can be closed and the regulator adjusted to the lower current. In this way considerable fuel can be saved when it is not necessary to run the lights at full brilliancy.

The commutator, which is shown in detail in Fig. 2, and complete in Fig. 5, is built up on a very substantial disk of hardwood veneering, which is mounted on a brass flange. This wooden disk is then faced with mica and each segment is screwed to it independently of the others. The segments are tapered slightly toward the inside, allowing slate wedges to be driven in between them, thereby protecting the mica facing from the action of any burning that might be caused by the flashing of the dynamo. The outside ends of the segments are held rigidly by a compound ring of mica and veneering, and each segment is held in position on this ring by a machine screw and two dowel pins. The segments are insulated from each other by air spaces, allowing both sides of each segment to be perfectly inspected and cleaned at any time when the machine is not running.

With an air insulated commutator the burning effect of flashing and short-circuits is confined almost entirely to the brushes, so that it is not necessary to turn down the commutator after bad flashing, as is the case with solid built commutators. The carbon brushes feed down and compensate for the burning as soon as it is over. All parts of the commutator which are connected with the circuit of the machine, are on the face of the wooden disk so that there are no parts behind the commutator which have to be cleaned to keep the insulation from running down. The segments are increased in size at the working part so as to provide for a long life and also to hold the flashing as much as possible in the working part of the segments.

The brushes are arranged to cover the commutator over the entire angle spanned by them, and whatever sparking occurs is concentrated at the tip of the brush. At the brush tip is provided a small independent brush which is automatically fed down to compensate for the increased wear due to the sparking at this point. This independent brush is so narrow that the brush angle remains practically constant, no matter how fast the brush may be worn away by sparking.

In some of the older forms of carbon brush-holders used on air insulated commutators, considerable annoyance was experienced from the noise caused by the chattering of the brushes. This has been almost entirely obviated by the construction adopted. In these brush-holders the main brushes cover several segments at once, and all the brushes are urged by springs in the direction in which the commutator rotates, so there is no chance for the brushes to vibrate. With these brushes it is not necessary to oil the commutator.

The operation of the machines is fully equal to that of the oil-surface wound type.

The lamps can be thrown off or on in groups equal to 10 per cent. of the capacity of the machine, from full load down to short-circuit, or vice versa, and the regulator will compensate for the changes without flashing the machine. Or the whole load may be thrown on or off instantly, and the regulator will compensate for the change in a few seconds.

The machines withstand without injury the ordinary accidents of operation, such as open-circuit and short-circuit, and either side of the circuit may be grounded to the frame and the circuit opened without injuring the insulation.

A test was recently made to ascertain the rise in potential at the terminals of an 80 light machine. A load of 90 lamps on a very short line was put on the machine, and the line opened as nearly instantaneously as possible at the switchboard. The potential was taken at the terminals of the machine with a Weston voltmeter. With the machine running at 4,500 volts the voltmeter swung up to 5,500 volts; when the circuit was opened, at a load of 3,300 volts, the needle swung to 4,400. This shows that there is no marked difference between the iron-clad and surface wound machines in this respect.

If the circuit had been opened in the middle of a long line, the rise in voltage and consequent strain on the insulation would have been so small as to be hardly worth figuring on.

The Western Electric company manufactures this type of dynamo for 50, 60, 80, 100 and 125 lights capacity, and is also prepared to furnish these sizes for direct connection to the standard high speed engines.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, February 29.—It is announced that Dr. Pupin of Columbia College has temporarily abandoned his experiments with the cathode rays. He will secure more apparatus, however, and continue his investigations during the latter part of next week.

The interesting announcement is made that the storage battery equipment of chloride cells for the Edison Illuminating company is about ready for operation.

On Wednesday the Rapid Transit Inquiry commissioners held their last session for the taking of testimony. They have until March 12th to file their report, and it is likely that they will ask for an extension of time. A. B. Boardman spoke in favor of Mr. Parsons' plans for an underground railway in Broadway, and Archibald Murray, associate counsel for the protesting property owners, defended the estimates of Mr. O'Rourke, the expert, who declared that Mr. Parsons' figures were too low.

In combatting a foolish statement that the use of electricity on the Brooklyn Bridge for car shifting would have a tendency to weaken the sustaining power of the big supporting cables of the bridge, Superintendent Martin said:

There is no reason whatever for any apprehension that the bridge structure may be weakened by electrolysis on the steel used in the construction of the bridge. The fact is that the wires supplying the current for the propulsion of these cars are completely insulated, and the current returns through the rails, which are also thoroughly insulated. There is no reason whatever to fear any damage to the bridge structure through electrolysis; the bridge cables themselves are large enough to carry all the electric currents that may be generated in this city or New York. All we would have to do would be to ground any such current, and that would be a very easy matter. Even if this were not deemed advisable we could lay a return wire at very little cost. At present the current for the trolley car is carried through an overhead wire, and the return current is carried through the rails, which are also completely insulated. If necessary we would lay a return wire to carry the current back to the motor-house, but this I do not believe will be necessary. The truth is that all this talk of any damage to the superstructure of the bridge because of electrolysis is wholly erroneous. No danger of damage to the wire superstructure can result from the use of electricity.

The public will have an opportunity to witness the new method of making pictures by the Röntgen radiation at the electrical exposition to be held in this city in May in connection with the nineteenth convention of the National Electric Light association. Mr. Edison has succeeded in making a picture through eight inches of yellow pine, and anticipates no trouble whatever in making instantaneous shadowprints. He has generously offered to send to the exposition his improved apparatus and his own corps of laboratory assistants. Mr. Edison will also send to the exposition his large collection of experimental apparatus and designs pertaining to his early work on his many inventions, much of which has never yet been shown to the public. W. F. O.

### Northwestern Notations.

MINNEAPOLIS, February 29.—The annual report of the Twin City Rapid Transit company for 1895 has been printed. A summary shows these figures: Total receipts, $1,988,803.44; total operating expenses, $979,484.93; surplus earnings, $1,009,318.51; net earnings, $258,479.46. The company spent $153,000 in improvements, and this item is not included in the above, and hence would reduce the net earnings by that amount. Of the important expenditures $125,949.44 is charged to construction, roadway and track, and went principally into paving along the tracks on Nicollet and Hennepin avenues. For equipment $21,684.98 was spent; machinery and tools, $1,565.38; real estate and buildings, $4,011.13.

It is understood that Dr. Holmes has offered D. McCartney $25,000 for the West Side street railway in Green Bay, Wis. If this amount is not satisfactory to Mr. McCartney, the value of the line will be determined by arbitration.

C. S. Benson, receiver for the Water, Light & Power company of St. Cloud, Minn., has notified E. E. Clark, receiver for the St. Cloud City Street Car company, that he will cease to act as superintendent of the street car company because he fears that in case of personal injuries he might be held personally responsible. E. E. Clark, although receiver, has never demanded possession and the street car company itself has disappeared, "without having its obituary published," as a local paper puts it. The receiver will probably operate the line until Judge Searle, by whom he was appointed receiver, shall return and direct what shall be done.

L. E. Walkins' bid to the city of Mankato, Minn., to furnish 2,000 candle power arc lights for $57.60 per annum, and to put in an electric street car line, was accepted by wire two days after the bids were opened.

The council of Little Falls, Minn., has voted to annul the contract with the Electric Light & Water company, passing the resolution over the mayor's veto.

The Fort Dodge, Ia., Light & Power company has let the contract for material and will soon begin construction on its railway line.

The Minnesota Canal company and the Altamonte Water Power company are trying to get together to purchase the water power in the St. Louis river, near Duluth, and utilize the power to generate electricity, which would be transmitted to Duluth.

John Martin, Sr., of Livingston, Mont., and others have a franchise for an electric light plant for Big Timber, Mont., and expect to begin work on the plant early in April. C.

## PERSONAL.

A. H. Pease, secretary and treasurer of the Hart & Hegeman Manufacturing company of Hartford, Conn., paid a flying visit to Chicago last week.

Lord Kelvin will reach this year his jubilee as professor of natural philosophy in the University of Glasgow. The anniversary will be celebrated on June 15th.

F. E. Drake, who has for years been identified with the Standard Electric company in the capacity of general agent and assistant manager, has entered the firm of W. D. Ball & Co., consulting electrical and mechanical engineers, with offices No. 1625 Monadnock block, Chicago. Mr. Drake's long experience in the commercial field of the industry and his practical knowledge of the requirements of central station, isolated plant and general practice will be of much value to the new firm and its clients.

## TRADE NEWS.

The New York Exhaust & Blow Pipe company, Hartford, Conn., has furnished and erected for the Premier Cycle Manufacturing company, Bridgeport, Conn., an exhaust system for removing the grit, rouge and lint from the polishing and buffing rooms. The company also installed a system for removing the smoke and fumes from the forges and brazing fires. It does an extensive business in this line. The New York office is at 136 Liberty street.

John T. McRoy, of the Builders and Traders' Exchange, Chicago, is displaying intelligence and enterprise in exploiting his excellent and inexpensive vitrified terra cotta conduit. A recent circular setting forth the merits of this safeguard against electrolysis will be sent on application. Inquiries for samples of the new product have already been received from England, France, Germany, Holland, Canada and each of the very large cities of this country.

The Bi-metallic Electric Transmission company has opened an office at 1204 Havemeyer building, New York. It is its intention to place bi-metallic wire upon the market, the wire being composed of copper and steel (steel core with copper sheathing), combining great tensile strength with conductivity and, at the same time, securing to the user the "bi-metallic" effect. The wire sold by this company is manufactured for it by the John

A. Roebling's Sons company and is claimed to be perfect mechanically as well as electrically

William H Bryan, the St. Louis consulting engineer, has entered into an agreement with H H Humphrey, by which the latter becomes associated with him in consulting, electrical and mechanical engineering Mr Bryan says that his special work in steam and mechanical engineering particularly in water works, steam heating and ventilation and boiler practice— has grown to such an extent as to demand almost his entire attention This left little or no time for electrical work, to which department, however, Mr Humphrey will now give his attention Mr Humphrey is thoroughly equipped for this work, both by education and practical experience, and stands high in the electrical fraternity of the West. This new arrangement went into effect March 1st.

The Standard Paint company, 2 Liberty street, New York, manufacturer of the widely known P & B. goods, has accepted the agency for the United States and Canada of the "Ship" carbons, manufactured in Vienna by Schiff, Jordan & Co. Electricians are already familiar with these well-known carbons, which have been handled here for some little time by Frank S. De Ronde. While the business will be continued by the Standard Paint company, Mr. De Ronde will give it his special attention, and look after it the same as heretofore. The company has arranged to carry a large stock of these goods in New York at all times, so as to be prepared to make prompt shipments. The carbons are claimed to be of the very highest order, and give a steady, brilliant light at a minimum current without dust, noise or hissing. To convince the skeptical, the importers will willingly send samples gratis on application. It will pay all those interested to at once correspond with the Standard Paint company, which, up to April 15th, will be at the old stand, 2 Liberty street; after that date it will occupy the new and larger quarters at 79 and 81 John street, necessitated by the steady and growing demand for the P. & B. products.

Graphite, which is one of the forms of carbon, and more generally known as plumbago or black lead, has come to be an important factor in electrical industries. It is a graphite crucible which is used for electrical smelting, and it is a graphite pencil or rod which is used as an electrode in the process of electrical smelting. It is graphite pulverized to an impalpable powder that is used in electrolytic work by the copper smelters. Pure flake graphite is also used for lubricating cylinders and bearings of engines and dynamos, and the same material often forms the pigment for protective paints for trolley poles, electric light poles, and roofs of dynamo plants and trolley car sheds. Graphite would therefore seem to be a very important factor in electrical industries. During the last year or two the demand has very greatly increased for graphite resistance rods. Unlike German silver, it is not necessary to take into account the factor of quantity. For instance a six-inch rod one-fourth inch in diameter may be made to have one ohm resistance or 10 ohms, or 1 000 ohms, or in fact almost any resistance that the electrician may require. The only reason for changing the dimensions of such rod would be either convenience or for radiating the heat when it is necessary to carry a current of considerable quantity at high resistance The Joseph Dixon Crucible company of Jersey City, N J, which was the originator of the graphite industry, and is now the most extensive miner, manufacturer and importer of graphite, has paid particular attention to the requirements of electrical engineers and is supplying the electrical industries with large quantities of material

## BUSINESS.

The new electric light plant about to be installed by the Brookside cotton mills, Knoxville, Tenn., will consist of a General Electric company's dynamo and a Ball engine made by the Ball Engine company, Erie, Pa.

The Graham Equipment company, 258 Washington street, Boston, claims that street railway companies can save tons of coal in their power houses daily by reducing weight through the use of Graham's spring-suspended steel-framed car, which is said to be much lighter, complete with wheels, than any other open car body without the truck.

Roth Bros. & Co., 30-34 Market street, Chicago, report a gratifying improvement in business during February, and say the prospects for a large demand for their dynamos and motors are unusually bright. They have a large number of orders on hand at present. The Roth dynamos and motors, it is claimed, have given perfect satisfaction wherever they have been installed.

The Packard Mogul lamp is slowly but surely working its way into public favor where large lighting units are required. The Electric Appliance company, the general western agent for this specialty, has closed several large contracts for these lamps during the last few months. The Ravenswood platforms and station on the Milwaukee division of the Northwestern railway are lighted by these lamps. The company furnishes special shades and street hoods for these lamps, which largely increase their efficiency.

W. D. Ball & Co., consulting electrical and mechanical engineers, 1625 Monadnock block, Chicago, is the style of the firm succeeding the partnership of Ball & Allen, which has been dissolved, Mr. Allen retiring. The new firm is composed of W. D. Ball, who has been well known in engineering circles for several years, and F. E. Drake, formerly the general agent and assistant manager of the Standard Electric company. The new firm will continue to do consulting and engineering work, Mr. Ball taking the technical end, while Mr. Drake will have the management, caring for the general business.

The general catalogue of the Shawmut Fuse Wire company of 93 Federal street, Boston, for 1896, is out. In presenting it the company states that the year just passed was the most prosperous in the history of its business, despite the persistent statement of some electricians that the fuse is more of a danger than a protection On this point the company makes some interesting observations "Overheating of conductors comes from continued excessive currents," it says, "and against these the fuse is adequate as a protection, and its use assures a minimum of trouble because it opens the circuit only when the excessive current continues long enough to cause overheating Time and current combined overheat conductors, time and current combined melt fuses. When this combination becomes excessive, the fuse operates; but it does not operate with the excess of only one of the factors, as the automatic cut-out does."

Judge Townsend in the United States Circuit Court in New Haven, on February 14th, handed down a decision dismissing the bill in the suit for infringement of patent brought by Ocron S. Platt, the Bridgeport, Conn., inventor and pattern maker, against the Bryant Electric company. The matter in dispute was the contact on the Bryant push and pull switch. Several years ago Mr. Platt invented a switch for use on electric lights. He secured a patent on it but it was not manufactured to any great extent at that time. In the meantime the Bryant people obtained a switch which was somewhat similar. Mr. Platt afterward learned that they were manufacturing what he believed was his invention and he instituted proceedings to test their right. The Bryant company denied that there was any infringement. It claimed that it was merely another application of old ideas. This view of the patent, it would seem, has been sustained by the Circuit Court, although the full text of the decision is not yet at hand.

Daniel Webster, for 15 years associated with the Babcock & Wilcox company, resigned his position with that firm on March 1st. Mr. Webster for the last 12 years has been connected with the manufacturing and construction department of the Babcock & Wilcox company, and has many friends among the large steam users and manufacturers throughout the United States, who will all be pleased to learn that he has accepted a position with the manufacturer of the Cahall boiler, the Aultman & Taylor Machinery company, Mansfield, Ohio. Although the Cahall boiler has demonstrated its superiority as a steam generator, still there are many cases where lack of head room or prejudice prevent the adoption of anything but a horizontal water-tube boiler. The company has, therefore, decided to immediately engage in the manufacture of water-tube boilers of this type, and Mr. Webster will have entire charge of this department. Aultman & Taylor expect to be ready to begin delivering the water-tube type of boiler by June 1st. H. E. Collins & Co., of the Bank of Commerce building, Pittsburg, Pa., general sales agents for the Cahall boiler, will act in the same capacity for the water-tube type.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued February 25, 1896.*

555,068. Electric Car Lighting Apparatus. William Biddle, Brooklyn, N. Y. Application filed December 24, 1894.

There are included the dynamo and the secondary battery, a working circuit to the secondary battery containing incandescent lamps, an electro-magnet in multiple arc with the incandescent lamps, and a rheostat and lever actuated by the electro-magnet for throwing into the lamp circuit from the secondary battery a resistance in case of abnormal development of current.

555,073. Short Distance Telephone Communication. Walter L. Bradshaw, Cincinnati, Ohio. Application filed September 28, 1895.

The hook in combination with the supporting ring is provided with a shank extending through the hole in the receiver case and through the spiral spring, and is loosely fitting but suitably held from turning and rigidly attached to near the middle of the curved plate, while contacts and wires are adapted to furnish a low resistance path either way from hook.

555,074. Electric Transformer. William Carter, Louisville, Ky. Application filed April 23, 1895.

This is an open iron circuit transformer in which is claimed the combination of a primary and a secondary coil, a series of contact plates to which the successive windings of the latter coil are connected, a stud carrying at one end a contact arm for traversing the plates, and at the other end an insulated disk, a conductor to which one terminal of the primary is connected, a pin arranged adjacent to the conductor, and to which is connected the other terminal of the primary, and means on the disk for opening or closing the primary coil coincidently with the movement of the contact arm.

555,075. Brake Apparatus for Railway Vehicles. Francois Chapsal, Paris, France. Application filed October 4, 1895.

The action of the brake is accelerated or diminished by an electrically controlled valve.

555,076. Electric Visual Indicator. Frederick W. Cole, Newton, and Winthrop M. Chapman, Needham, Mass. Application filed June 3, 1892.

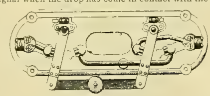
Several spring-actuated intermittingly and successively operating indicating surfaces, and an electro-magnet controlling their intermittent operation are combined with a single timing mechanism controlling their successive operation, the releasing or controlling lever of which is released or caused to operate by that indicating surface which operates in response to the first impulse received.

555,090. Secondary Electric Clock. Fred L. Gregory, Chicago, Ill. Application filed May 11, 1895.

A rotative toothed power wheel is employed, together with an actuator and an impulse pawl in operative connection with it, and in position for engaging the teeth of the power wheel, a locking detent in position and adapted for engaging and locking the power wheel intermediate to successive operations of the impulse pawl, a pawl locking and detent releasing device in position and adapted for simultaneously actuating the pawl and detent to lock the former in and release the latter from engagement with the power wheel, and means for intermittently operating the actuator.

555,101. Electric Annunciator. John Kips, Yonkers, N. Y. Application filed January 8, 1895.

Claim one follows: The combination with the drop, pivoted at the spring, having the catch at its free extremity, the insulated stud, the taut wire extended from said stud to the spring, the bar pivoted and arranged to arrest by contact the descent of the drop, of a battery, the wire from one pole of which connects with the taut wire, while that from its opposite pole connects with the drop to actuate a signal when the drop has come in contact with the bar.



NO. 555,112.

555,112. Hanger Board for Arc Lamps. August J. Oehring, Chicago, Ill. Application filed September 18, 1894.

There are a base-board, a pair of binding posts mounted thereon, comprising each a lower portion and a cap adapted to be secured thereto, the cap being provided upon one end with a perpendicular arm, to which the conductor extending to the lamp may be attached, and the caps being capable of attachment to the lower portions, with the arms upon the inside or upon the outside, whereby narrow and wide frame lamps may be accommodated.

555,113. Scenic Theater Apparatus for Producing Sun Effect. August J. Oehring and Albert L. Tucker, Chicago, Ill. Application filed May 13, 1895.

In the combination with the stage of a scenic theater, a pivoted arm at the rear and to one side of the proscenium opening, and carrying lamps upon its end is employed; also a horizontally traveling lamp carriage above the proscenium opening, a pivoted arm situated upon the opposite side of the stage to the rear and to the side of the proscenium opening, and carrying lamps upon the end thereof, and means for rotating the pivoted arms advancing the carriage and lighting and extinguishing the lamps.

555,114. Circuit Controlling Apparatus for Scenic Theaters. August J. Oehring and Albert L. Tucker, Chicago, Ill. Application filed May 13, 1895.

A continuously rotating drum carrying lugs or projections upon its surface, two pairs of contacts adapted to be closed together by the lugs, an electro-magnet in circuit with each of the pairs of contacts, a clutch controlled by the electro-magnet, and the traveling contact of a rheostat controlled by the clutch.

555,120. Electrical Annunciator. Frank Porath, Appleton, Wis. Application filed July 6, 1895.

The combination with a steam boiler, of a disk secured to the end thereof and provided with a screw-threaded boss, and with a split sleeve having depending ears, a flanged nut having a screw-threaded socket to receive the boss, and provided with a screw-threaded tubular extension, a stuffing nut secured on the extension, a rod having a slot at one end, a float pivoted between the ears and provided with an upturned end to engage the slot, an electric alarm and a connection between the alarm and the sliding rod, whereby when the float rises or falls the electric circuit will be completed and the alarm sounded.

555,130. Electric Welding Indicator. Elihu Thomson, Lynn, Mass. Application filed July 23, 1888.

The combination with the conductor and the register operated or controlled by the current in the conductor, of the iron bar or strap fastened transverse to the conductor, and an armature arranged to be attracted to the strap.

555,131. Electric Riveting. Elihu Thomson, Swampscott, Mass. Application filed October 20, 1890.

The method of fastening two pieces of metal or other material together consists in abutting them together with a countersink or cavity formed at their meeting faces around an opening through them, placing two pieces of metal in the opening with their ends abutting at the cavity formed by the countersink, and then subjecting the pieces to end pressure while heated to plasticity, so as to unite the abutting ends and form an expansion into the cavity.

555,136. Electric Elevator Controller. Ernest P. Warner, Chicago, Ill. Application filed October 29, 1892.

Claim one is given: In an electric elevator controller the combination with a shaft, the rotation of which may be controlled by the operator in an elevator car, of cams mounted upon said shaft, the contact arm of a rheostat, a reversing switch, and linkage between said cams and said contact arm and said switch respectively, whereby the electric motor actuating said elevator car may be controlled.

555,145. Trolley Wheel Switch. Philip A. Williams, Decatur, Ill. Application filed June 10, 1895.

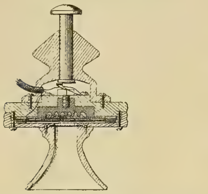
A switch for trolley wires is described, comprising a plate having grooves in its under surface extending from each side of the main wire to the corresponding side of each switch wire, holes extending obliquely upward through the metal left between grooves, recesses in the upper surface above the holes, and clamp bars above the recesses.

555,152. Constant Potential Alternating Generator. Walter K. Freeman, Fort Wayne, Ind. Application filed July 5, 1895.

The combination is claimed with a system of generator regulation embodying a pulsating current generator, a transformer having its primary in series with the working circuit of the generator, and its secondary controlling the energizing of the field of force, of a current regulator controlled by the speed of rotation of the main drive shaft interposed in the secondary circuit of the transformer, whereby the energy of the field of force is governed in accordance with both the rate of rotation of the drive shaft and the consumption of energy in the working circuit.

555,154. Telephone Transmitter. Alfred Graham, London, England. Application filed May 3, 1894.

This instrument includes the combination of a glass diaphragm, a movable electrode composed of a carbon disk carried thereon, a stationary electrode composed of a block of carbon having molded integral therewith a series of short conical studs, a body of carbon granules surrounding the studs and interposed between the electrodes, a conducting ring mounted on the edge of the glass diaphragm, a soft flexible connection (such as metal foil) connecting the movable electrode and the conducting ring, and circuit connections for the conducting ring and the stationary electrodes.



NO. 555,154.

555,165. Telegraphic Repeater. Lewis Horton, Jr., Reading, Pa. Application filed December 14, 1895.

The apparatus includes two main circuits entering a single station, two relays, one in each line at the station, a local circuit containing an electro-magnetic spring contact, transmitting instrument operated by the relays respectively, an electro-magnetic retractor for the armature of each relay, and an extra local circuit for each retractor, the extra local circuit of one relay retractor, say the first, including the down contact stop and movable or armature contact operated by the automatic transmitter controlled by the second relay, whereby a break in the second circuit, due to the operation of the first relay, occurs after a break in the retracting circuit of the second relay, and vice versa.

555,167. Electric Railway Signal System. Joseph Irwin, Omaha, Neb. Application filed February 18, 1895.

As described, there is an arrangement comprising a track having its rails at each station divided into six insulated sections, 1, 2, 3, 4, 5, 6, of which 2 and 4 are grounded. A visual signal is employed, comprising two signal disks and four magnets operating them, a single circuit wire between the stations, and a single battery at each station connected to the rail sections, the magnets, the line and the ground.

555,190. Alternating Motor. Nikola Tesla, New York, N. Y. Application filed May 15, 1888.

The first claim is reproduced: In an electro-magnetic motor, the combination of independent energizing circuits, one adapted to be connected with a source of alternating current, the other arranged in inductive relation to the said first circuit, whereby the motor will be operated by the resultant action of the two circuits.

555,191. Electric Motor. Elihu Thomson, Swampscott, Mass. Application filed December 19, 1890.

The combination is claimed in an electric motor, of a divided armature core, two field magnets acting respectively upon the two parts of the divided armature, and means for varying or changing the relative effects of the field magnets in proper manner to restore the speed to normal.

555,192. Electric Lighting System Sylvanus L. Trippe, New York, N. Y. Application filed June 21, 1893.

The arrangement comprises a dynamo or other source of electric current, and a plurality of circuits, a transferring device for changing the current from one circuit to another, a series of shunts for allowing a portion of the current passing directly to the first-mentioned circuits without passing through the transferring device, and resistances interposed in such shunts.

555,199. Spark Arrester for Arc Lamps. Charley Winston, Memphis, Tenn. Application filed February 28, 1895.

The device consists of two hinged semi-cylindrical shaped sections, angular boxes or supplemental sections arranged on the top of the semi cylindrical main sections, and resilient doors or strips arranged in the main and supplemental sections, and having their outer edges rigidly secured and their inner edges free, and adapted to bear upon the carbon and form a double guard to prevent the escape of sparks and exclude insects or foreign matter.

555,208. Conduit Electric Railway. Christopher M. Bridges, Seattle, Wash. Application filed May 31, 1895.

In combination with a series of rollers in the conduit, normally out of electrical connection with a supply conductor, a contact bar is carried by the car and adapted by contact with the rollers to throw them successively into electrical connection with the conductor, and a hanger from the car passing through the slot of the conduit and secured to the flexible bar, the hanger having the extremities of its arms fitted with oscillating pins to which the contact bar is secured, whereby it effects the bending of the bar to conform to the direction of travel.

555,216. Armature Winding Walter H Knight Schenectady N Y Application filed April 13 1895

As a new article of manufacture, an armature for a dynamo-electric machine having a slotted core and windings disposed in the slots upon the face of the armature, the windings consisting of individual coils, each being in the shape of a six-sided figure composed of two trapeziums, having their common side missing and lying in different but parallel planes, the two trapeziums united by portions of the coil approximately radial to the circumference of the core to which it is to be applied.

555,217. Electric Signaling Device for Railroads. Gustav A. Lyncker, Munich, Germany. Application filed April 27, 1895.

Included in this arrangement are the electric circuit, with signals at the terminal stations, the intermediate stations having signals in series on one side of the line, the contacts at the stations, the connections across the line at the stations including the contacts, whereby signals will be sent ahead of the train at each station, and the signal in rear will be cut out, the contact at the sending station and a supplemental circuit including a signal at the sending station, and a contact at the first intermediate station.

555,222. Railway Telephone System. William H. Nixon, Providence, R. I. Application filed January 28, 1895.

The claim: A railway telephone system, consisting of a metallic conductor, two telephones, one at each end of said conductor, means for completing the circuit between said telephones, a second metallic conductor, normally electrically connected to the opposite pole of one of said telephones to that to which is connected the other metallic conductor, a switch normally closed to make the connection of the second metallic conductor and telephone, but capable of being opened, and a series of pairs of branch wires, from the metallic conductors normally open but capable of being electrically connected together by a portable telephone.

555,239. Telephone. Manious Garl, Akron, Ohio. Application filed April 4, 1895.

There is employed a helical L-shaped spring, having attached to the free horizontal portion of the spring the diaphragm, which is free to vibrate with the spring, the electrode and a receiver.

555,248. Electric Railway. William H. Jordan, Brooklyn, N. Y. Application filed January 17, 1896.

A divided signaling circuit is employed, with a switch at each end of the circuit, a connection from one switch to the working conductor, a connection from the other switch to earth containing signaling devices, and means at each switch operated by the contact devices carried by the car for operating the switch, whereby the signaling devices are successively connected with each division of the signaling circuit.

555,252. Electrical Propulsion of Vessels. Ernest A. Le Sueur, Ottawa, Canada. Application filed March 26, 1894.

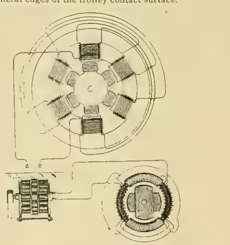
The means here set forth for the electrical propulsion of a vessel consist of a conduit located beneath the surface of the water, a conductor in the conduit, insulating fluid of greater specific gravity than water within the conduit, and a contact or collecting device electrically connecting the conductor with the current-using device of the vessel.

555,259. Electric Heater. James F. McElroy, Albany, N. Y. Application filed May 31, 1895.

In an electric heater the combination is claimed of a casing containing a resistance adapted to be heated by a current of electricity, a partition placed in the rear and upper portion of the casing, whereby an air space is formed between the partition and the back and top of the casing through which air can circulate, the casing containing air ports, permitting air to enter the air space at its lower portion, and to emerge from the air space at its upper portion.

555,263. Contact Device for Electrically Propelled Vehicles. Emil B. W. Reichel, Gross-Lichterfelde, Germany. Application filed August 15, 1895.

A contact device for electrically propelled vehicles, made with a revoluble trolley contact surface, and one or more laterally extended sliding contact surfaces having detachable or renewable portions next the side or adjacent peripheral edges of the trolley contact surface.



NO. 555,190.

555,266. Underground Conductor System for Electric Railways. Carl T. H. Schwieger, Berlin, Germany. Application filed November 15, 1895.

The first claim is for the combination with a series of contact terminals adapted to normally rest in a depressed position, of an operating rod or part the end of which normally projects into the path of a wheel or other part of the vehicle, mechanism between the contact terminals and the rods for raising the contact terminals when the rods are depressed, a rod or part provided in connection with each contact terminal, adapted to occupy an elevated position when the contact terminal is raised, and a wheel or other part carried on the vehicle adapted to engage and depress the rod to return the contact terminal to its normal position.

555,286. Electrical Measuring Instrument. Friedrich von Hefner-Alteneck and Hans Görges, Berlin, Germany. Application filed November 25, 1895.

There are a solenoid adapted to be traversed by the current to be measured, two rods of iron of such thickness that they will be magnetized to saturation by the weakest current to be measured, the rods being disposed as near as possible to the coils of the solenoid, a balance, upon one end of which the rods are hung, the other end of the balance being suitably weighted, and means for indicating the position of the balance.

555,291. System of Control for Electric Motors. Elmer A. Sperry, Cleveland, Ohio. Application filed February 16, 1895.

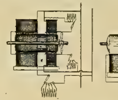
The arrangement described comprises the combination with an electric motor of a current supply, a current controller for the motor circuit having a moving part, a device responsive to variations in electric current connected with such motor circuit for decreasing the counter-electromotive force at constant speed of such motor, and means connected with such controller for holding the responsive means out of operation during a portion only of the movement of the moving part.

555,297. Spark Arrester. Gustaf A. Anderson, Waynesborough, Pa. Application filed September 3, 1895.

A bundle of corrugated plates is arranged vertically in the outer case, and having vertical zigzag passages between the plates.

555,301. Regulating Electric Distribution System. James Burke, Schenectady, N. Y. Application filed December 24, 1894.

The method of regulating the potential in an electric circuit consists in supplying the circuit with current from main sources of supply of different potential, and regulating the potential of the supplied current by intermediate variable sources of electromotive force which act inversely upon the main sources of supply to reduce the potential of the one and raise the potential of the other.



NO. 555,191.

555,303. Primary Battery. Walter A. Crowdus, Chicago, Ill. Application filed June 12, 1895.

This is a primary battery, having two or more cells, partitions dividing such cells, a metallic conducting piece hanging from and extending lengthwise with the dividing partition, a negative element or elements supported thereon, and a positive element hooked over and supported by the negative element support to electrically connect such cells in series.

555,304. Primary Battery. Walter A. Crowdus, Chicago, Ill. Application filed October 4, 1895.

A negative element for primary batteries is described, consisting of a reticulated supporting conducting plate provided with a porous coating of baked copper oxide and a carbonized binder.

555,305. Electric Lamp for Vehicles. Walter A. Crowdus, Chicago, Ill. Application filed October 4, 1895.

A battery cell is employed, provided with a metallic supporting piece, a lamp having a metallic back portion, one of such portions provided with a projecting hinge and the other with a hinging perforation, and means for placing and locking the lamp on its supporting piece.

555,313. Electric Clock. Sigismund Fischer, Brooklyn, N. Y. Application filed May 10, 1895.

The essential features are a swinging pendulum and its crutch, a recessed block on the crutch, a fulcrumed circuit-closing lever, a gravity pendant pivoted to one end of the lever adjacent to the block, and a circuit-closing device operated by the opposite end of the circuit-closing lever when the pendant is engaged by the recessed block.

555,326. Electric Distribution System. Eugene C. Myrick, Providence, R. I. Application filed May 23, 1893.

An electric circuit containing one or more lamps or other translating devices, and a fuse box, a shunt circuit extending around the fuse box, an annunciator arranged to be operated by the passage of a current through the shunt circuit, and means for breaking the shunt circuit when the annunciator has been operated.

555,440. Illuminated Sign for Electrically Driven Street Cars. Robert H. Engle, Garden Lake, N. J. Application filed March 8, 1895.

The device consists of a casing having in one or more of its sides a translucent or transparent plate, and having a lamp with narrow cylindrical bulb projecting longitudinally into the casing from either end, means for mounting the casing, and reflectors extending longitudinally through the casing above and below the lamp, these reflectors being in a horizontal plane longitudinally, but inclined transversely and the opposed upper and lower reflectors being reversely inclined.

555,452. Process of and Apparatus for Electrolytically Forming Tubular Bodies. Ignatz Klein, Budapest, Austria-Hungary. Application filed December 7, 1894.

The process of electrolytically forming and condensing metallic bodies of circular section consists in immersing cathodes of the desired number and longitudinal profile in the form of rollers in a suitable electric bath, depositing the metal upon the cathodes and rolling them upon an immersed rolling plate of corresponding profile while the deposit is taking place and until the process is completed.

555,470. Sectional Conductor for Electric Railways. William H. Baker, Pawtucket, R. I. Application filed March 21, 1895.

One claim is appended: In a sectional electric railway, the combination of conductor sections, mechanical means whereby the moving trolley is caused to progressively connect the said sections with a continuous electrical conductor or feeder, said means comprising a lever at the initial end of each section arranged to be depressed by the said trolley as the latter advances upon the said section, and a second lever arranged to be depressed by the first-named lever and constituting an electrode of the conductor section adapted to make contact with an electrode of the continuous conductor, and an electro-magnet continuous with the electrode of the continuous conductor and arranged to co-operate with the second-named lever as an armature, and thereby restrain the electrodes in contact after the trolley has become disengaged from the first-named lever and during its engagement with the conductor section.

# Western Electrician.

**EVERY SATURDAY.**

Vol. XVIII. CHICAGO, MARCH 14, 1896. No. 11


## Use of Stops in Sciagraphy.

While much of the so-called experimenting with X-rays that has occupied public attention has been merely in the nature of repetition of tests conducted by Professor Röntgen and others, there has been considerable valuable work done in perfecting apparatus and standardizing methods. At the laboratories of Queen & Co., Philadelphia, M. E. Leeds, manager of the electrical department, and J. S. Stokes, manager of the chemical department, have been busily engaged in conducting experiments with a view of obtaining data which would show the most desirable form of Crookes tube for producing X-rays. These investigators, in the course of their experiments, have found it advantageous to use lead diaphragms in which circular holes, varying in size from one-quarter inch to one inch, were made. These disks were placed immediately under the Crookes tube used, and resulted in cutting off all X-rays except those coming from the holes. By this means pictures with sharp definition were gotten. Three of these pictures are herewith reproduced. The rattlesnake, Fig. 1, is a specimen from Kansas, and was about 2½ feet long. The fish, Fig. 2, is an ordinary perch about eight inches long. The small mammal, Fig. 3, is a shrew, about the size of an ordinary mouse.

Messrs. Leeds and Stokes have found it advantageous to use Crookes tubes, one end of which is made of uranium glass blown out very thin, exactly under one of the electrodes. This is used as the cathode and is found to generate X-rays very satisfactorily. The pictures which are reproduced were made with a coil giving only 1½ inch spark.

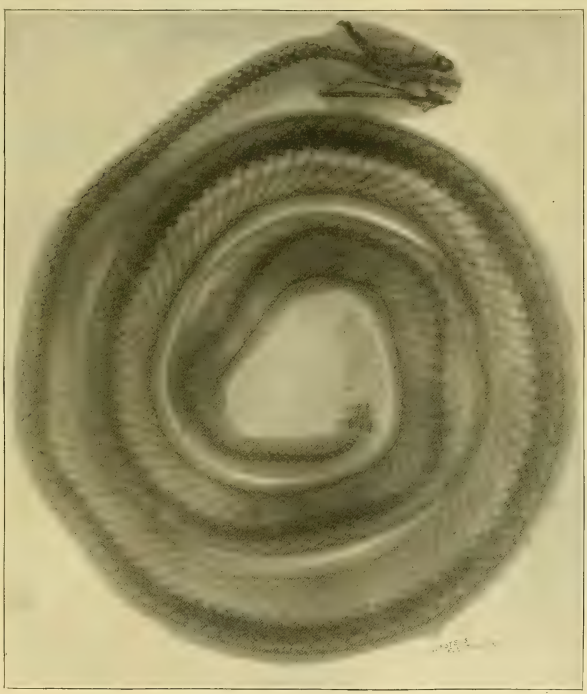


FIG. 1. USE OF STOPS IN SCIAGRAPHY (RATTLESNAKE).

## Wiring Rules.

It has been decided to extend an invitation to the Underwriters' National Electric association to send a delegate to the joint conference upon wiring rules to be held at New York on March 18th and 19th, the work of which and plan of organization were outlined in the WESTERN ELECTRICIAN February 29th. In addition to the organizations to be represented officially at that conference, a list of complimentary delegates has been prepared, these gentlemen being invited to attend in an advisory capacity. These gentlemen, by reason of their experience, the nature of their occupation, their identification in the past with work such as the proposed joint conference will consider, together with their prominence in electrical engineering matters, have been considered by the committee as likely to lend valuable advice and additional strength to the joint conference. The list of complimentary delegates includes William MacDevitt, inspector Board of Fire Underwriters, Philadelphia, Pa.; A. E. Kennelly, consulting engineer and expert, New York; W. J. Jenks, electrical engineer and expert, New York; A. H. Henderson, chief inspector Fire Department, New York; Morris W. Mead, superintendent Bureau of Electricity, Pittsburg; William A. Anthony, consulting engineer, E. H. Johnson, New York; S. E. Barton, New York; E. V. French, inspector Factory Mutual Fire Insurance company, Boston.

The committee of the National Electric Light association has in preparation a transcript of the several codes most extensively in use, and this, in a convenient and compact form, will be in the hands of each delegate prior to the meeting, at which a large amount of additional matter bearing upon American and European practice will be available, and it is the intention that in the consideration of the rules presented at the joint conference the decision as to what shall be adopted for the national code will be governed solely by the law of the "survival of the fittest."

Seattle, Wash., has repealed its wire-burying ordinance.

## Stereoscopic Röntgen Pictures.

By ELIHU THOMSON.

While experimenting with the making of shadow pictures, it occurred to the author that it would be desirable to secure some indication of the position in space of various embedded solid objects, or, in other words, to obtain a pair of pictures which when placed in a stereoscope would show solidity. This would manifestly be useful in surgical examinations, as the true relations in space of the parts of a bone, or of a foreign body and the bone would become evident. The ordinary Röntgen pictures are simple shadows on a plane surface. It is impossible to tell from such a shadow whether one object or part of an object is front or back of another. There is, however, no difficulty in determining the real positions when resort is had to the production of stereoscopic shadow pictures.

The first trial made by the author was completely successful, objects appearing in high relief. The process consists simply in exposing a covered plate in the ordinary way and repeating this with the objects and Crookes tube relatively displaced somewhat from the first position. The rays thus pass through the objects in two somewhat different directions, a record of the shadows being made for each direction. Prints from the negatives so produced are mounted for use in the stereoscope. The effect is very curious. A cork or block of wood having nails or screws driven into it in various directions is clearly shown and the screws or nails in their proper positions. When two heavily insulated wires twisted together constitute the object, the metal wires alone are seen, but standing apart in space, one around the other.

The bones of two superposed figures are to be seen in their correct positions. The complete skeleton of a mouse, or other small animal, may thus be recorded so as to be seen in relief, each bone in its proper space relation to the others.

It may be possible as a development of the use of Röntgen rays stereoscopically to arrange two fluorescent screens, or even a single screen, to be viewed by the eyes and receive the image or shadow in such manner as to produce the stereoscopic effect; thus, if the Crookes tube have two cathodes a distance apart, which are connected to the electric source alternately, and with considerable rapidity, while small shutters are synchronously opened and closed before each eye, respectively, one of the eyes would at all times receive the impression given by the rays from one of the cathodes, while the

other eye would always receive the impression produced by the rays from the other cathode, and thus stereoscopic observations would be the result. This method of producing the stereoscopic effect is similar to one which has been tried and used successfully in stereopticon work; two lanterns being arranged to throw upon the same screen in nearly superimposed positions two slides which are stereoscopic in their relation to each other. A set of diaphragms was arranged passing in front of the lantern tubes synchronously with similar diaphragms passing before the eyes of the spectators, whereby each eye always received its appropriate image on the screen, the result being to give solidity to the scene depicted.

## Final Decision in Regulator Patent Litigation.

In the United States Circuit Court of Appeals for the Seventh Circuit a decision was handed down during the January term in the appeal of the Thomson-Houston Electric company against the Western Electric company on the regulator patent. The case was argued by Frederick P. Fish, R. S. Taylor and George R. Blodgett for the appellants, while Barton & Brown appeared for the appellee. The case has been in court for several years, and as, the interests involved are considerable, the opinion sustaining the ruling in the lower court, which was in favor of the Western Electric company, is given in full.

The objections made to the opinion of the court in this case will be considered briefly, though some of them can be of but little importance, because directed to matters which were expressly waived when the 10 propositions of counsel for appellant were assumed to be true. The essential question is whether on that assumption a consistent and proper conclusion was reached.

The statement in the opinion that the second patent does not specify "in just what feature of the construction or of the mode of use the novelty and utility entitled to be called invention were supposed by the patentees to be found," has been misapprehended. No reference to the requirements of section 4,888 of the Revised Statutes was intended. In the first paragraph of the statement of the case it had been said that the controversy turns mainly upon a comparison of the patent in suit with the earlier letters, No. 223,659, and in order to make that comparison the court was seeking an exact and undisputed statement of the "improved construction and mode of use of the apparatus employed in patent No. 223,659," in which the patentees supposed their second invention to consist,

FIG. 2. USE OF STOPS IN SCIAGRAPHY (PERCH)

and, not finding what was desired in the specification of the patent, quoted from their brief the statements which counsel had found it convenient, if not necessary, to make in aid of their discussion of the question, which the court, as best it could, was endeavoring first to state and then to solve. There had been no suggestion that the claims of the second patent did not meet the requirements of the statute and it was not in the thought of the court to question their validity on that ground.

It is now contended that in comparing the two patents only the face of the letters and not the evidence concerning the construction and operation of devices made in alleged exemplification of the patented devices, should be considered. Accordingly the suggestion in our opinion concerning the first patent that "it does not seem to follow, necessarily, that no current was intended to pass through the controller magnet *A*, except current resulting from the difference of potential between successive segments at the moment when the forward one passes from under the main brush," is denied, and quotations are made of parts of the specification, and of the first, fifth and seventh claims of the patent to show that "in every part of the patent from beginning to end," "the patentees have affirmed over and over, by argument and by inference, that the current which flows in the accessory circuit is that due to the difference of potential between the successive segments as they pass from under the main brush," and so it is assumed to be unquestionable "that patent No. 223,659 describes, on its face, an apparatus in which an accessory collector takes up the current due to difference between the potential of the leaving segment and the one under the main brush, but no other," and that "the two patents described devices which differ palpably in their mechanism and in the principles and modes of operation attributed to them

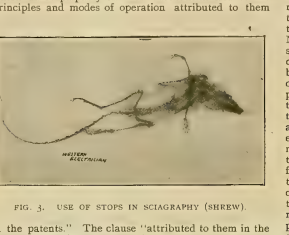



FIG. 3. USE OF STOPS IN SCIAGRAPHY (SHREW).

in the patents." The clause "attributed to them in the patents" is italicised in the briefs, and, as stated, means that it must be determined whether the two patents cover different devices and inventions by a mere reading of the specifications and claims, unaided by the proofs, however satisfactory, of the actual operation of devices constructed in illustration of either patent; or, as it is elsewhere expressed, the intention is "to hold the discussion where it belongs—to the patents as they read." To this mode of discussion section 4,888 is pertinent. It requires that an application for a patent (not the claim), shall contain a written description of the supposed invention and of the manner of constructing and using it "in such full, clear, concise and exact terms as to enable any person skilled in the art . . . to make and use the same;" and it follows that, in determining whether the invention described in one patent differs from that described in another, evidence may be heard, and in a difficult case manifestly ought to be heard, concerning the construction and actual operation of each. Specifications and claims are




FIG. 2. USE OF STOPS IN SCIAGRAPHY (PERCH)

necessary, but inventions consist in things, not in words. To quote from the petition upon another point: "In the construction of a patent it is not the personal intent or understanding of the patentee, but the actual facts regarding the invention that are material." This is equally true when two patents are being construed and compared for the purpose of determining whether the devices are essentially different. It may be conceded to have been the clear intention of the patentees by their first letters to cover an apparatus in which an accessory collector takes up the current due solely to difference of potential between the leaving segment and the one under the main brush; they may have understood that to be the chief and possibly the only valid feature of invention, but it is at the same time evident that the claims are not all so limited, and, unless there is something in the prior art of which proof has not been made, the patent ought not to be so restricted. It is conceded that "in the second, third and fourth claims the accessory collector and controller magnet are included as parts of the combination without any express limitation as to the origin of the current which flows through them." Indeed it is clear, as shown by questions 39 and 40 and the answers thereto, set out in the statement of the case, that there may "always be found flowing in the accessory circuit some current other than that due wholly to the difference of potential between the adjacent segments," and, though it is plain that if that current should not be sufficient to overcome the retractile spring which opposes the magnet of the combination, the effective operation of the apparatus would depend upon the varying current produced by the varying difference of potential between adjacent segments, it is also clear, as stated in our opinion, after quoting from the specification, that "it does not seem to follow, necessarily, that no current was intended to pass through the controller magnet *A*, except current resulting from the difference of potential between adjacent segments." a fact which it is shown could be determined only by the employment of suitable tests upon each apparatus. It may be added, as a deduction from what has been said, that if the current in the accessory circuit, which results from the difference of potential of the brushes when touching a single segment, is barely insufficient to overcome the spring opposed to the magnet *A*, a change in the external circuit, causing an increase in the main current, would cause a corresponding increase of the opposed current in the accessory circuit sufficient to overcome the spring, independently of "the electrical condition of the segments of the commutator at the moment of leaving the collectors;" and this being a new apparatus, in a measure at least, or theoretically, is responsive to changes in the main current, as well as to the varying differences of potential between segments, and, when actually so, is to be regarded, according to the contention of the appellant, as an exemplification of the second rather than of the first patent. But could it be insisted that an apparatus of that character, if made during the life of the first patent, either before or after the issue of the second, would not have been an infringement of the first? We think not. On the contrary the statement may be repeated, with added emphasis, that in respect to the question of invention, the omission of the accessory brush is of no significance," since its presence or absence does not effect essentially the mode of operation nor determine whether a particular apparatus exemplifies one patent or the other.

But it is said that "such a doctrine would destroy all the electrical patents in existence," and, to illustrate the assertion, reference is made to the telephone of Reis, which was capable of transmitting music, and to those of Bell and Blake, which were the first to transmit articulate speech. The devices of the different patents, doubtless, are much alike in appearance and construction and in the mode or principle of operation, but it is enough to observe here that they produce distinctly different results, which are perceived and understood without the employment of any tests other than the practical use of the devices in the manner and for the purposes for which they were respectively designed and patented—a test which is certainly not unfair or illiberal. It may be conceded, as asserted, that the differences of operation could be brought about by mechanical changes so minute that the most expert telephonist in the world, taking an instrument at random out of the line, could not tell, by mere inspection of it, whether it would be a Reis or a Blake in operation and result; but a mere hearing would be enough. So, too, in respect to the Edison incandescent lamp and the old form of lamp known as the Konn lamp, whatever the possibilities of the converting one into the other by gradual and hardly perceptible changes, it is evident, on the statements and explanation of counsel, that the difference between the lamps both in construction and in operation is clear enough to distinguish one from the other. By way of further illustration it is said that "there is a cabinet in the Agassiz Museum at Cambridge containing a row of mounted skeletons beginning at one end with a monkey, and ending at the other with a Caucasian. The difference between the extremes is wide enough, but the two half-way chaps look like brothers." But they are not brothers. By neither man nor monkey has a live one of either kind ever been mistaken for the other, and in skeleton, with all the zeal of the Darwinians to find the missing link, they remain, to the experts, easily distinguishable, and can only be said to resemble. In the light of present knowledge, the Caucasian, as an invention, is not anticipated by the simian.

It was understood to be admitted at the hearing, and if not admitted was sufficiently proved, as stated in the opinion, "that upon all dynamos which existed when the patents were issued the two devices were interchangeable, so that when the brushes were so moved as to prevent spark, they established and maintained constant current." But it is not material to the argument whether the statement is strictly accurate or not. It remains true that upon dynamos of uniform field each device prevents spark and maintains constant current, while upon dynamos of irregular field neither device can be successfully employed unless provision is made for a variable spread of the commutator brushes. With that provision it is agreed that the device of the second patent is effective for both purposes, and though questioned by counsel (hesitatingly) we are convinced that the same is true of the device of the first patent.

The statement that "If, instead of being in the acces-

sory current, the (controller) magnet be transferred to the main current, or a shunted portion thereof, exactly the same kinds of operation, effected in the same way and by like adjustments, must go on," is criticized and disputed, but not upon grounds which are new and unconsidered or which seem to us to affect the essential truth of the proposition. Identity of operation and of adjustments, it is to be observed, is not alleged, and of the differences insisted upon our views are sufficiently developed in the original opinion.

It is said that the course of the case and the opinion of the court have developed an importance, not apprehended at the beginning, to the question whether it was known, "prior to the discovery of the fact by the Thomson and Houston that the current of a dynamo could be maintained at a constant value under variations of load by movement of the brushes," and, assuming that the court was misled in that respect, counsel have restated and elaborated at great length their discussion of the difference between shifting the brushes to change the current and shifting them to maintain constancy of current, in the outer circuit. The question is confessedly a collateral one only, and without attempting to restate or summarize what has been said about it, we are content to say simply that when the opinion in the case was written the court had the same understanding as now of the respective views of counsel in regard to it.

The objections made to the last sentence of our opinion are answered already. If the current regulator was not covered and protected by the first patent, it is because the claims are too narrow to cover the entire invention shown; but on the proofs in the record we think it clear that some of the claims are entitled to a construction broad enough to cover the supposed invention of the second patent. It would certainly be unreasonable to say that infringement of the first patent could have been avoided by proportioning the parts of the device, whether done intentionally or accidentally, so as to admit of the passage of an effective part of the main current through the accessory circuit; and yet, as counsel for the appellant have been constrained to contend, when so adjusted the device is covered by the second patent. In other words, at least one form of construction of the first device exemplifies the second. It is therefore beyond dispute, as originally stated, that to uphold the second patent would be "an unwarrantable prolongation of the just monopoly conferred by the first patent."

The petition is denied.

## Arc Lamp Posts for Chicago West Side Parks.

The cut shows the new arc lamp post now being manufactured from the design of Forée Bain, electrical engineer for the West Side park commissioners, for the extensive electric lighting system of the West Side parks and boulevards of Chicago. One thousand of these poles have been contracted for, and as the post is composite—of iron and wood—the essentials of safety, cheapness and gracefulness seem to have been admirably combined. The economy of the pole is shown by the following contract prices:

| | |
|---|---|
| Iron portion (Union Foundry company, Chicago) | $21.75 |
| Switches (Hart & Hegeman Manufacturing company, Hartford Conn.) | 2.25 |
| Wooden portion (Michigan Pipe company, Bay City, Mich.) | 2.16 |
| Total cost of each pole | $26.16 |

The price given includes delivery and distribution at the chosen sites in the parks and boulevards. The total cost for the entire order is $26,160. The wooden part is of Norway or Georgia pine treated with preservative. The cut shows only the upper portion of the pole, the iron base and sub-base being the same as the earlier design shown in this journal on November 23, 1895.

## Röntgen Rays from Incandescent Lamp Bulbs.

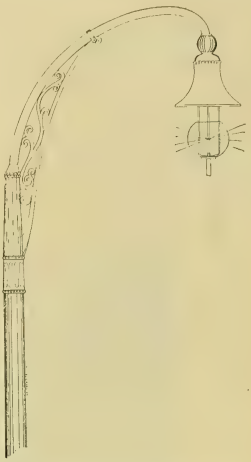
Incandescent lamp bulbs have been suggested as substitutes for Crookes tubes in the experiments with the X rays, but have usually been rejected as having too low a vacuum. Experiments in this line, however, show that it is possible to obtain real sciagraphs or shadowprints, or whatever the new pictures may be termed, when this substitution is made, although the results thus far are far inferior to those obtained by the original method in strength and clearness.

Professor Joseph F. Smith of the Department of Physics in the Northern Indiana Normal School at Valparaiso, Ind., has been experimenting with improvised tubes of this character, and he sends to the Western Electrician the negative from which the reproduction in Fig. 1 is made. The picture is very indistinct, but it shows that the X-rays from an incandescent lamp bulb penetrated substances ordinarily opaque in this case wood and ebonite—and left impressions of a trunk key and a silver dollar on a sensitive plate.

FIG. 1. RÖNTGEN RAYS FROM INCANDESCENT LAMP BULBS.

The apparatus used is shown in the diagram, Fig. 2. The prime conductor *A* was energized by a Toepler-Holtz machine and connected with the Leyden jars *B B*. The discharge was taken from the coatings of the jar to the binding posts *C* and thence by wires of opposite polarity to the incandescent bulb *D*. The lamp was held upright in the frame *G*, which was provided with sliding connecting rods. The sensitive plate was held upright at *E*. *F* represents the tinfoil electrode at the bottom of the lamp. A slow plate (No. 16) was used, enclosed in an ebonite plate-holder. Pyrogallic acid was used as a developer.

A copper wire was fastened to each of the brass contacts of the lamp bulb and twisted together, making one electrode. A disk of tinfoil three inches in diameter was fastened by shellac upon the outside of the end opposite the brass electrode. The tinfoil was connected by a wire to the outer coat of the one jar and formed the cathode. The two brass electrodes were connected by a wire to the outer coat of the other jar and formed the anode. The spark used varied in length from one-half inch to five inches and could be regulated by the prime conductor. The sensitive plate was left in the plate-holder with ebonite cover. Upon the outside of the ebonite cover was placed a silver dollar and a trunk key. The coin and key were covered by pieces of wood one-fourth of an inch thick and held in place by rubber bands. The plate-holder thus arranged was fastened in a vertical position about two inches from the tube. The exposure lasted three-quarters of an hour. When the sparks were discharged through the tube it became filled with a glow of greenish-yellow light which was densest at the cathode.



ARC LAMP POSTS FOR CHICAGO WEST SIDE PARKS.

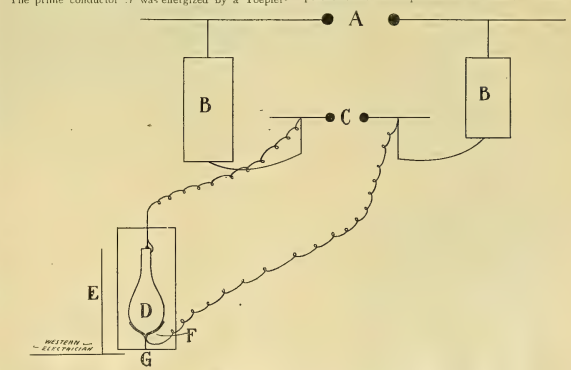



FIG. 2 RÖNTGEN RAYS FROM INCANDESCENT LAMP BULBS.

About 25 different lamp bulbs were tried. Of these two gave Röntgen effects—one an Edison 16 candle power lamp and the other a Sunbeam 32 candle power. The rays seemed to be discharged in every direction from the cathode.

The Lincoln Park commissioners (Chicago) have purchased 250 ornamental arc lamp-posts that were in use in the World's Fair at $20 each. These posts will be used in the new lighting system soon to be installed in Lincoln Park.

## Reproduction of a Sciagraph by Röntgen.

No doubt considerable interest will attach to the accompanying illustration, which is a reproduction of a cut in the *Yale Medical Journal* made from a sciagraph taken by Professor Röntgen at the State Physical Laboratory at Hamburg, January 25th, and showing a vicious union after fracture of the left forearm. Commenting upon this illustration the *Yale Medical Journal* says editorially:

The photograph is, we believe, the first reproduction in this country of a distinct pathological process taken from the living subject. The faulty union of the broken bones is brought out clearly and distinctly. This is but a forerunner of the possibilities of this latest discovery, the recognition of the value of which has produced a feverish agitation in the minds of scientific investigators. Among these possibilities is this, that the surgeon can take advantage of this process in cases of doubt, where for any reason he is uncertain as to the diagnosis of a fracture, or the position of the bones.

Though up to this time there has been little difficulty in differentiating between bone and other tissues in the photographs, also between flesh and foreign particles of greater density where bone did not intervene, earnest and eager efforts are being made to so gauge the intensity of the rays emanating from the cathode that differences between the softer tissues may be rendered appreciable to the eye, so that not only foreign particles can

*D. Drahtwülste.*
*K. Knochengeschwulst.*
*H. Hautgewebe.*
*S. Speiche. (Radius.)*
*E. Elle. (Ulna.)*
*B B' Bruchstelle.*

REPRODUCTION OF A SCIAGRAPH BY RÖNTGEN

be discovered in the body, but also the presence and condition of pathological processes be determined. Relative to this, it may be said, through the kindness of Professor A. W. Wright, we were permitted to examine a photograph of a hand, taken at such an angle that the blood vessels at the extremities of the fingers were distinctly visible, and another of a rabbit where the outlines of the heart and lungs were distinguishable. The difficulties standing before the realization of the accurate photography of pathological conditions are, viz., the indistinct outline of parts and the lack of delicacy of shading of tissues of nearly equal density. The solution of these difficulties is a matter of regulating the intensity of the rays and the media through which the rays pass before reaching the object, and as the advance of the microscopy of tissues and minute organisms was largely due to the knowledge of staining of tissues, so here by varying the intensity of the rays and the time of exposure of the plate it is possible that more sharply outlined photographs may be taken. Should the period of exposure be sufficiently reduced to a few minutes, may not the rapid changes attending some pathological processes, as for instance inflammation be watched, as the growth and reproduction of the bacteria beneath the lenses of the bacteriologist's microscope.

## Consular Reports on Röntgen's Discovery.

In the consular report issued by the State Department March 5th, at Washington, three interesting communications appear on the Röntgen discovery. One is from Charles De Kay, consul-general at Berlin, another from J. C. Monaghan, consul at Chemnitz, and the last from C. W. Chancellor, consul at Havre. In all of these communications the impression is given that scientific and official circles in Europe are stirred up over the X-ray investigations.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

A company has been formed at Keosauqua, Iowa, to put in a telephone system.

E. B. McGill of La Crosse soliciting subscribers for a proposed telephone system to run from La Crosse to Viroqua.

The Iowa Union Telephone company expects to build a line from Clinton, Iowa, to Dixon, in the spring.

The First National Bank of Mayville, N. D., contemplates building a telephone line to Hatton, N. D., in the spring.

The new telephone exchange at Baraboo, Wis., is a success. It started with a 100 plug switchboard, but was compelled to order a 200 plug board very shortly. The line will be extended to Reedsburg, Kilbourn City and other points next summer.

R. E. Jennings, representing local capitalists, has been granted a telephone franchise at Menominee, Mich., and will make application for one across the river in Marinette, Wis.

The franchise granted the Phœnix Telephone company at Mankato, Minn., has expired and nothing was done by that company.

Business men of West Bend, Ia., are arranging to put in a telephone system. They have 24 subscribers.

Telephone connection will be made between Barron, Rice Lake, Cameron, Chetek and Cumberland, Wis., in the early spring. A stock company has been organized.

There is agitation for a telephone exchange at Owatonna, Minn.

The Wolf River Telephone company has applied for a franchise at New London, Wis., and proposes to build a line to Waupaca as well as put in an exchange for New London.

The projectors of the new telephone company at Oconto, Wis., say that work will be begun on the exchange in the early spring.

The council of Owatonna, Minn., contemplates putting in a telephone system to be owned and operated by the city.

The Livingston, Independence & Cooke City Telephone company at Livingston, Mont., sued C. S. Hefferlin to recover $75, alleged to be due on subscription to capital stock. The defendant admitted subscribing for the stock, but claimed that at a subsequent meeting the company reduced the capitalization without his knowledge or consent, and that when he learned of the change he donated the first payment and notified the secretary and treasurer he would withdraw. The court instructed the jury that if the change was made without the knowledge or consent of the defendant to find for him, but if he were present at the reorganization, he had by his silence at that time waived his right to interpose objection. The jury found for the plaintiff.

The Western Electric Telephone company is soliciting subscribers in Rochester, Minn., with a view to making long-distance connection.

Two telephone companies are endeavoring to get a foothold at New Hartford, Ia.

A company has been organized to build a telephone system in the upper Yellowstone Valley, connecting Livingston, Mont., with Gardner, Cinnabar, Mammoth Hot Springs, and points in the National Park.

The Blue Earth Valley Telephone company of Winnebago City, Minn., has been delayed in its extensions by the non-arrival of poles. Connection will be made at Alden, Minn., with the Western Electric Telephone company, which is building to Minneapolis and St. Paul from Iowa. The Blue Earth company has three lines in successful operation, viz.: The Nashville line, the Elmore line, and the line east to Wells and Alden. A fourth line to Lake Crystal and Mankato will be built in the spring.

The independent companies of the Upper Michigan peninsula are considering forming an offensive and defensive alliance against the Bell company. The new Menominee and Marinette company will build to Powers, and there connect with the lines from Iron Mountain and Escanaba. The Marquette County Telephone company will build to Escanaba, thus forming a circuit of the leading cities of the peninsula. It is said the Bell company has but one subscriber at Iron Mountain and none at Escanaba.

The Northwestern Telephone Exchange company is securing a right of way for a telephone line from Grand Forks, N. D., to Grafton and Park River.

The Northwest Telephone company of Dickinson, N. D., has secured a right of way and began work on its line.

The Western Electric Telephone company is canvassing West Concord, Minn., with a view to putting in an exchange.

From Webster City, Ia., it is reported that the telephone companies of the state are after the Iowa Union

and the Central Union companies, and if the move that is on foot crystallizes they will give the Bell monopoly some sharp competition. A call for a meeting has been signed by the Home Telephone company of Sioux City, the E. H. Martin Telephone company of Webster City, the Boone Telephone company of Boone, the Cedar Valley Telephone company of Waterloo, the Marshall Telephone company of Marshalltown and the Home Telephone company of Oskaloosa, the largest independent companies in the state, to be held in the city of Des Moines March 19th, for the purpose of effecting the organization of such an association They also re-

FIG 1. FRENCH MILITARY TELEPHONES —COMBINED STATION AND LINEMAN.

quest all other companies in the state in opposition to the Iowa Union and Central Union companies to be represented at such meeting. "The meeting will probably result in a combination of all the companies," says Mr Martin. "The lines of our company will be extended half way in every direction to meet other independent Iowa exchanges, and a consolidation of all the companies is favored."

E. Hart of Elroy, Wis., will extend a telephone line from Elroy to Valley Junction, via Kendall, Clifton and Tomah this summer.

The Woodbine Telephone company of Woodbine, Ia., is a late incorporation, which proposes to build several lines as soon as possible.

The Marshall Telephone company of Marshalltown, Iowa, has its exchange nearly completed. There are 300 instruments contracted for.

Geo. W. Cornwall expects to have the exchange in Deadwood, S. D., opened by April 1st.

The Rocky Mountain Bell Telephone company at Butte, Mont., has purchased a site and will erect an exchange building in the early spring.

The Northwestern Telephone Exchange company will give the weather signals along its long-distance line in North Dakota, from the signal station at Moorhead, Minn.

The Steele County Telephone company of Sherbrooke, N. D., contemplates reorganizing and connecting Hope, Clifford, Portland and Mayville by telephone in the spring.

The Northwestern Telephone Exchange company has decided to build 748 miles of new long-distance telephone line this season in Minnesota, North and South Dakota.

At the annual meeting of the directors of the Winona Telephone company of Winona, Minn., the secretary reported 382 instruments in use. The Northwestern Telephone Exchange company was given a vigorous "roast" for its style of competition. That company was charged with attempting to exterminate the home company by intimidation, ruinous competition of free instruments, and by endeavoring to stir up discontent among its patrons. The claim is made that the Northwestern never had but 175 subscribers, and now has but half that number, three-quarters of whom are served gratuitously and the remainder at a merely nominal rate.

The Spokane & Columbia Telephone & Telegraph company has incorporated, with headquarters at Spokane, Wash., to build into Rossland and Traill, B. C. Other lines are projected to Carson City, Greenwood City, and up as far as Penticton. In all 224 miles of line are proposed. Work will be begun as soon as a charter can be obtained from the provincial government. N. R. Stone is its promoter.

Judge Siebecker in the Circuit Court in Madison, Wis., has ordered the Western Union Telegraph company to grant the same service to the Dane County Telephone company that it does to the Wisconsin Telephone company for transmission of messages over its wires, by placing a telephone in its office. Two requests of the Dane company have been unnoticed, and unless the Western Union now grants the permission it must appear at the March term of court and show cause.

## French Military Telephones.

A French officer of the line has recently introduced into the army an invention, or rather an adaptation, of the telephone principle, combining all the advantages of compact, durable construction, ready installation and perfect work. He uses a single naked wire, utilizing the earth for return, and experiment has shown that for 20 kilometers good results are readily accomplished by magneto telephones, with the uncovered wire lying on the ground, provided good earth connections are maintained at the terminals.

The wire adopted, according to *La Nature*, is bimetallic, a core of steel surrounded by copper. The qualities possessed by such a conductor being conductivity, solidity, flexibility and light weight, cheapness and freedom from liability to rust. It has been found that by the use of small dry batteries, which are also used to strengthen the magnet effect in the calling magneto, more positive results are obtained

The telephone station is built on the back of the operator's assistant, and, as shown in Fig. 1, is as much a part of his outfit as the strap under his chin. In his hand he carries the reel of wire, which is so connected that when ordered to halt and "ground," he has only to stick the sword bayonet in the earth, and his end of the line is in order for business. Fig. 1 shows him on duty as a lineman, stringing wire; Fig. 2, transacting business, while in Fig. 3 he is acting as general manager. "hello

FIG. 2. FRENCH MILITARY TELEPHONES.—THE SUB-STATION "BUSY."

girl" and messenger combined. In the company service there are four operators in command of a corporal, and in addition there are on the regimental staff a corps of operators for communicating between the regimental and superior officers.

At headquarters on the battlefield are stationary exchanges reaching to all necessary parts of the field. The outfit of a human regimental station comprises six kilometers of the wire mentioned of .60 millimeter gauge on six spools, six receivers, three camp tables, four ground plates and four telephone hooks. As this installation may remain for some days intact, care is given to setting it up. The weight of each spool when full is 3.5 kilogrammes.

The amount of wire being known, rude measurements are made by its aid. The company operator is used to connect the sentry boxes with the guardhouse and headquarters, and for connecting detached parties separated by woods, rocky country, etc., while making explorations.

Fig. 4 represents the established line of a regiment, consisting of four posts two kilometers apart. The corporal takes position at *A*, fixes his telephone to his ear, and makes contact to the line and to the sword bayonet which he has placed in the earth. The peripatetic station, in its role of lineman, starts on a run, allowing the wire to unroll and keeping as nearly in line as possible, but favoring points where the wire may be readily hung on bushes, trees, etc. A helper follows who hangs up the line, where practicable, on trees, buildings and fences, and permits it to lie on the ground only when unavoidable. Having run out his coil of 2,000 meters, he makes his connection with line, telephone and earth, and calls back to test the line. A second section, then the third, is gone over in the same manner. The operators stand by their bayonets, the helper meantime acting as lineman and repairer in case of accident.

In changing positions on the march, on patrol or reconnoitering, constant contact with the earth is necessary. To insure this the operator holds his scabbard in his left hand, and, this being attached to the line, forms a ground contact through his body and feet. As the receiver is strapped to his head, he hears all that is said by the corporal or any other operator, when if necessary he halts and responds. The cavalryman is also capable of using the telephone on a march, the ground contact in this case being through the bit, the body and the

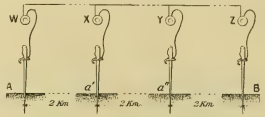



FIG 4. FRENCH MILITARY TELEPHONES.—LINE READY FOR OPERATION. W, X, Y, Z, STATIONS TWO KILOMETERS APART. A, A,' A," B, SWORD BAYONETS AS GROUND WIRES.

shoes of the animal he is riding. His telephone, like that of the infantry operator, is strapped to his ear.

## American Institute of Electrical Engineers.

At the meeting of the Institute on February 26th the report of the committee on incorporation was read, and a resolution empowering the council to proceed with the work of incorporation was unanimously adopted.

The discussion of Mr. Sprague's paper on electric elevators was then taken up, in accordance with a vote of the meeting January 22d, when lack of time prevented some members from participating. The discussion was re-opened by Dr. Hutchinson, who was followed by George Hill, R. P. Bolton, H. Ward Leonard and others.

At the meeting of council in the afternoon the following named associate members were elected: Daniel Adamson, Hyde, Cheshire, England; Isaac F. Badeau, Samuel D. Collett, Edward P. Decker, Edwin S. Reid, Edward Sullivan, New York, N. Y.; Samuel L. Foster, San Francisco, Cal.; Eugene E. Griffes, Los Angeles, Cal.; Ralph L. Montague, Bannack, Mont.; E. C. Sharpe, Los Angeles, Cal.

The following named associate members were transferred to full membership: George D. Shepardson, Minneapolis, Minn.; Henry A. Sinclair, New York, N. Y.; Paul N. Nunn, Telluride, Colo.; George H. Winslow, Pittsburg, Pa.; William D. Gharky, Philadelphia, Pa.; Walter C. Fish, Lynn, Mass.

## Convicted of Holding Up a Trolley Car.

Two men have been convicted in Chicago of "holding up" a trolley car between this city and Evanston.

FIG 3 FRENCH MILITARY TELEPHONES.—REGIMENTAL STATION, GENERAL MANAGER AND "HELLO ".

They are John Carr and John Smith. It will be remembered that at eight o'clock on the night of October 7th, a trolley car on the North Shore Electric railroad was signaled to stop at Evanston and Berwin avenues, near Edgewater, and five men, wearing masks, entered the car at the front and rear doors and robbed the eighteen passengers. At the trial both Smith and Carr were identified by half a dozen of the passengers who were robbed. There are still seven indictments against the alleged robbers.

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**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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THE publication offices of the WESTERN ELECTRICIAN have been removed to much more commodious quarters. Our new address is Suite 510 Marquette building, Dearborn and Adams streets, Chicago.

The telephone number remains unchanged, Main 1746.

NEVER before in the history of the Bell interests was there such determined opposition to that corporation, and never before was there such a hopeful outlook for competing companies. In the pending litigation over telephone patents it is believed the anti-Bell forces will present a solid front, and in the crusade against the present excessive rates that are being charged in many states advantage will be taken of the experience that former movements have furnished. So greedy have been the Bell people that very little public sympathy is wasted upon them. The sentiment of the entire community is strongly in favor of competition where practicable, and in any event a radical reduction of charges is imperatively demanded.

COMPARATIVELY few people realize how much effective work has been done in disseminating valuable information upon electrical subjects by the New York Electrical society, which is now in its fifteenth year. A circular recently issued by the secretary of the organization gives a brief outline of the work thus far accomplished and enumerates the principal topics discussed by the society. It also gives an idea of the future policy of the organization and proves conclusively that the association is worthy of support and encouragement. The members are doing a real service to the community without ostentation and pretension and they are deserving of great credit.

IN anticipation of the annual meeting in May at which new officers will be chosen for the ensuing year, the American Institute of Electrical Engineers has caused to be placed in the hands of its members a circular explaining the rules of the organization governing the nomination and election of officers, together with the list of offices to be filled and the names of the present incumbents whose terms of office expire at that time. It will be noticed that the name of William A. Anthony heads the list of retiring vice-presidents, and consequently it is not to be wondered that his friends look upon him as the logical candidate for the presidency. But the Institute in this case must depart from the rule which it has generally followed if it hopes to retain its self-respect, and it must reject Prof. Anthony's claims for preferment in no uncertain way. He has made himself so obnoxious to the respectable element of the electrical fraternity by his Chicago connections that we doubt very much if he could secure a nomination upon the regular or opposition ticket. The Institute can not afford to stultify itself by honoring a man who has so little regard for his personal reputation as to lend his name to a questionable enterprise like the scurrilous publication with which Prof. Anthony is connected, and for which, as one of its editors, he is responsible.

A WELL-INFORMED correspondent predicts for the telephone bill now pending in the Legislature at Albany a fate similar to that which befell its predecessors. It is not denied that there is urgent demand for legislation, nor is it disputed that able and influential men are supporting the measure now pending, but it is explained that just as soon as there is danger of the bill becoming a law, the lobbyists, who are now in the background, will come forward and assume control of the measure, smother it in committee or load it down with amendments so that it cannot possibly pass. But this will only be done, it is explained, when the telephone companies shall have made their peace with the lobby. Such condition of affairs is greatly to to be regretted, if it really exists, and it should be the aim of every self-respecting man to put a stop to such practices. The only way this can be effectually accomplished is by exposing everybody connected with such a disgraceful proceeding. There are plenty of men interested in the proposed legislation at Albany who would not stoop to such measures as are proposed by the lobby, or take advantage of them, and the same may be said of many of the gentlemen interested in the management of the telephone interests. Then why not combine these forces against the boodle element at Albany? It would be a great victory for right-minded men who believe in and follow higher methods and business standards. At any rate all telephone legislation at Albany should be subjected to careful scrutiny.

A RECENT contribution to one of the German electrical journals recalls the fact that half a century ago the necessity of protecting telegraphic apparatus from abnormal currents of electricity was felt, and the writer says that, while it has been perfectly satisfactorily accomplished, he thinks that for electric lighting and, power installations and conductors something definite and positively effective is needed. While the temporary removal of the former class of conductors from the reach of the electrical disturber is easily and thoroughly accomplished, there are cogent reasons why this treatment is impracticable with power and lighting currents, and in addition to this, the well-known fact that a normal current will follow the lead and maintain an arc where lightning has traced the way, renders the problem one of great importance, and correspondingly difficult of solution. It has been suggested that a commission of competent electricians should be appointed before whom all devices should be brought, and by whom all possible tests should be made, in view of the general recommendation of some one or more successful devices. How this can best be accomplished is problematical, but that there is a necessity for some positive prevention of such mishaps, if such does not now exist, is plain and urgent. In this country it has been found very hard to effect reforms by commissions, for such bodies are generally susceptible of influences that lessen their power for good, and this knowledge has made the people look with suspicion upon their work. In all probability we will have to content ourselves with the gradual progress that will naturally come through business competition.

IN view of the efforts now being put forth to keep up an interest in the discussion of the proposition to have the government control the telegraph, this question arises: Is there a popular demand for the proposed change? We believe there is not, and this view is strengthened by the fact that with the retirement of Mr. Wanamaker from the position of postmaster-general the movement, which he had supported so strongly, dropped almost out of public sight. Of course there are always to be found persistent reformers who cling to their theories and advocate them on all occasions, and some of these are now presenting their views on this topic through the medium of magazine articles. There can be no question of the zeal and disinterested motives of the leaders of this movement. We may doubt their wisdom, but we cannot deny their sincerity. It should be remembered, though, that in the half of a century during which this topic has been under discussion there has never been anything like a great popular demand for the proposed change, excepting possibly one occasion, and that was based upon the prejudice aroused against the Western Union Telegraph company by the great operators' strike. But this exhibition of public feeling did not last long enough to make a permanent impression, for the people generally were not sufficiently interested in the telegraph to keep their attention riveted upon the issue, and it soon dropped out of public view. As early as 1873 a determined effort was made to get Congress to take action upon the subject, but the measure failed, and not until Mr. Wanamaker's crusade against the telegraph companies did any administration again take an active part in the controversy. Many plans have been proposed, but none has found sufficient favor to lead Congress to adopt it. There are a good many reasons for this condition of affairs, the principal one of which is that the service given by the private companies that now control the business is as good as could be expected under the most favorable conditions if the telegraph was under governmental control, and, besides, the charges are reasonable and, what is more to the point, they are borne directly by the person receiving the benefit of the service. The postoffice authorities agree that were the government to undertake this branch of public service there would be as a consequence a heavy annual deficit added to that of the regular postal department, and this would have to be borne by the public at large irrespective of any advantages derived from the service. This is a very obnoxious feature. The people of this country as a whole do not wish to provide special advantages for a few. Residents of Montana do not wish to pay for an efficient government telegraph service in New York and Chicago, when a private corporation willingly supplies just as good service at the same cost, and the persons who reap the advantage pay for it. In discussing this subject advocates of the government scheme call attention to the fact that most of the great foreign powers control the telegraph. That is because the service could not be maintained otherwise in those countries; in fact, in some of the old world countries it would have been impossible to have established extensive systems of telegraph without governmental assistance, and if this patronage were withdrawn it is not at all probable that the service would survive. It is not private enterprise but public patronage upon which great enterprises depend in most foreign countries. It will be readily admitted that such conditions are not desirable in America. We want all the improvements and advantages that genius can devise and wealth procure, but not at a sacrifice of our national policy of encouraging private enterprise.

## Another Trolley Decision.

A decision has been made by Judge Townsend of the United States Circuit Court for the District of Connecticut, upon the Van Depoele patent No 495,143, for the under-running electric railway trolley system.

A few months ago Judge Townsend handed down a decision sustaining the validity of this patent upon final hearing in a suit against the Winchester Avenue Railroad company. Shortly after further suits were brought in Connecticut against the Billings & Spencer company of Hartford and the Kelsey Electric Railway Specialty company of New Haven Judge Townsend has just decided these suits in favor of the Van Depoele patent, and granted motions for preliminary injunctions after full argument on both sides.

The court holds that to supply essential or characteristic parts of the trolley system is a contributory infringement, and will be enjoined by the courts, even though the defendants may not supply or use the patented combination or system in its entirety. The court further held that an unlicensed maker of trolley bases could not be permitted to supply such bases even to railroads which had been originally fully equipped by the General Electric company.

From the court's opinion, it appears that the defendants in this instance made and sold trolley stands or bases they urged that such bases were not covered in detail by the patent as a separate article of manufacture, and further contended that they at least might be lawfully sold to or used by purchasers to repair or replace parts of original equipments furnished by the Thomson-Houston and General Electric companies under the authority of the Van Depoele patent. But the court held that neither of these things could be lawfully done; first, because the supply of parts of the patentee's system is in reality intentionally aiding other parties in the unlawful making, selling or using of the patented system as a whole, and secondly, because the replacement of a lawful by an unlawful trolley base or stand is not a legitimate repair, but a reconstruction of the combination patented.

In other words, infringement and injunction cannot be avoided by making up a complete system of parts gathered together from various sources, but, on the contrary, all parties who contribute toward the infringement of the entire combination by supplying necessary and durable parts thereof are themselves infringers and subject to injunction.

A large number of prior decisions were referred to by the court, where rulings of a similar nature have been made, which establish the general doctrine that any supply of parts amounting to the intentional promotion of the act of infringement by others will be restrained by injunction, and that the full scope of the Van Depoele patent cannot be avoided in this way, even if the parts so supplied or used are not claimed by themselves alone as specific and separate features of the patented invention.

## Electrical Instruments on the Free List.

A recently rendered decision by the Board of General Appraisers is that of the Columbia College of New York against the collector of customs at the port of New York, relative to the rate and amount of duty chargeable on certain merchandise imported by the college on July 20, 1894, per steamer Majestic. The merchandise in question consisted of certain electrical instruments—two standard ohm units, one standard resistance, one alternating current wattmeter, one Siemens wattmeter. It was claimed by the college authorities that these goods should have been entitled to free entry under paragraph 677 of the act of October, 1890, which reads as follows: "Philosophical and scientific apparatus, instruments and preparations, especially imported in good faith for the use of any society or institution incorporated or established for * * * philosophical purposes * * * and not intended for sale." The board concurred in the claim, and the protest was accordingly sustained.

## Siamese Market for American Electrical Goods.

Too little is known in the United States about Siam, its people, products, needs and general foreign trade. Siam, the principal country of southeastern Asia, has an area of about 250,000 square miles, equal to that of California and Oregon combined. There appears to be a good opportunity for a good responsible American house or trading company. If such were started with sufficient capital, with managers who would study the needs and desires of the people, selling both directly and on commission, introducing all kinds of American products that might find a market, and providing a means for the Siamese to have direct relations with the exporters of the United States, it can hardly be doubted that it would be successful. It may be said that when a merchant in Siam wishes anything which is or can be manufactured in the United States, he is at a loss how he shall proceed to get it, and sees before him long delays of correspondence and inquiry before he has sufficient data to place his order. On the other hand, he goes to the local British or German house, and in a few minutes can determine the order. Were a responsible American house established this great difficulty would be obviated. The duty placed on importations is three per cent. Drawback of the full amount of duty will be allowed upon all goods found unsalable and re-exported. There is an excellent market in Siam for new electrical apparatus, like short-distance telephones and electric fans, electric railway equipment, etc. All signs now indicate that the great battle for the commercial supremacy of the world is to be fought out during the next 10 years. It will be a plain case of the survival of the fittest. Will the United States be the fittest?

## Added Equipment for Armour Institute.

Several noteworthy additions have just been made to the dynamo and power equipment of the Armour Institute of Technology. An arc dynamo has been especially built for its laboratories by the Standard Electric company. It is of 20 light, 10 ampere capacity. The equipment includes a number of Standard arc lamps and an arc light ammeter. Another arc dynamo has been purchased from the General Electric company. This is also of 20 light and 10 ampere capacity, and the shipment includes a number of single and double arc lamps of the well-known Thomson-Houston make.

A 30 horse power Westinghouse multipolar motor has also been added to the power equipment, being the second added the present year, the other having a rating of 20 horse power and being of the same type. A contract is being placed for the third alternator. This will be of a late type, single-phase and 16,000 alternations.

The transformer equipment has been increased by the installation of a Westinghouse 17.5 kilowatt transformer of the latest type adopted by this company.

The total dynamo capacity at present installed is about 140 kilowatts, and motor capacity about 70 horse power.

A new consignment of apparatus from Elliot Brothers includes a very accurate set of standard resistances and three Ayrton electrostatic voltmeters. These last have just been tested and found to be very accurate and sensitive. They are in use for arc light and alternate current determinations.

## Statue of Franklin for Philadelphia.

It has been a long reproach to Philadelphia that she has no fitting monument to her most illustrious citizen, Benjamin Franklin. The University of Pennsylvania and the American Philosophical society, by their good works, keep his memory green, but there is nothing in the city that speaks directly to the passer-by of the journalist, philosopher and diplomat; nothing that makes his figure familiar to the throngs that fill the streets. Fortunately this will soon cease to be the case. A correspondent writing from Philadelphia says that John J. Boyle, the well-known sculptor, has been commissioned by Justus C. Strawbridge to model a statue of Franklin and to have it cast in bronze. The entire expense of the work, which will exceed $10,000, will be borne by Mr. Strawbridge, of whose admiration for the character and ability of Franklin this statue will be a lasting expression.

## Deserved Rebuke.

[From the New York *Sun*.]

We are not surprised to learn that there are many men who lay claim to the discovery of the wonderful power of the "X-ray," which Prof. Röntgen of the Würzburg University has brought to the knowledge of the scientific world, which promises to be of extraordinary service to mankind. From several countries, even from our own country, we have recently heard the utterance: "Oh, we discovered it, or we experimented with it, or we knew all about it, long years ago; we can knock out Röntgen's pretensions to the discovery of it."

The trouble with all these claimants is that they forgot to send out the news, or neglected to communicate a knowledge of their experiments to their scientific brethren, or had made so many other successful experiments in unknown fields of research that they thought nothing of the "X-ray" or the use of it, or the money they could make out of it.

There are always lots of pretenders whenever any scientific novelty is brought out, and their question is "Didn't you know that already?" Indeed, Mr. Wiseacre! we did not.

## Power Interests at Niagara Falls.

There is every prospect that Niagara power matters will form the topic of very earnest discussion in the New York Legislature before it adjourns. This will be so because Assemblyman Dudley of Niagara has introduced a bill to confirm and establish the rights of the Niagara Falls Hydraulic Power & Manufacturing company and permit of the enlargement of its plant until it can develop 200,000 horse power. The bill is made necessary from the fact that this company has never received the state's permission to divert water from the Niagara river, despite the fact that it is the oldest power company at the falls. The method of power development employed by this company was fully described in the illustrated article by Mr. Dunlap in the WESTERN ELECTRICIAN of February 8th last, and the contemplated improvements were then noted. The text of the bill that is destined to arouse some little strife is as follows:

Section 1. The Niagara Falls Hydraulic Power & Manufacturing company and its grantors having been for more than 50 years the owners of lands bounding on and extending from the Niagara river at Fort Day, through the city of Niagara Falls to the westerly shore of the river below the falls, through which lands the hydraulic canal of said company is located, and by means of which canal said company and its grantors, as riparian owners, have for about 40 years taken, drawn and used and leased and sold to others to use waters from Niagara river for domestic, municipal, manufacturing, fire and sanitary purposes, and said company has developed power therefrom for its own use and to lease and to sell to others for manufacturing, heating, lighting and other business purposes, the right of said company so to take, draw, use and dispose of water from said river for the purposes mentioned, and develop power therefrom, and to use and dispose of such power for the purposes mentioned, is hereby recognized, declared and confirmed, and its exercise declared to be lawful. But said right of said Niagara Falls Hydraulic Power & Manufacturing company to take and draw water from Niagara river for use and for disposal to others to use for the purpose above specified, and for the development of power for its own use and for disposal to others to use for the purposes above mentioned, is hereby limited and restricted to taking out and drawing of so much water from such river as shall be sufficient to produce 200,000 effective horse power; provided that exercise of by said company of the rights hereby declared and confirmed shall not impair the practical navigation of Niagara river.

This proposed grant of 200,000 horse power will place the Canal company on the same basis as the Niagara Falls Power or tunnel company; that is, each will have a grant of 200,000 horse power. Increased interest is attracted to the bill from the fact that it is in direct opposition to the desires of the commissioners of the State Reservation at Niagara, who, in their annual report to the state Legislature, openly proclaim their opposition to all power projects, fearing that the diversion of water will mar the beauty of the state's possession. While it is likely that the bill will have the enmity of the reservation commissioners, it will not be opposed by the Niagara Falls Power company, for, when interviewed on the measure, Secretary Rankine, of that company, said:

I have read the proposed bill to grant the Schoellkopf company the right to take water from the river, and believe that it is important in the interest of power development at Niagara that the Schoellkopf company should have a right to take water from the river. Their want of this right has subjected them to attacks on the part of persons who unduly fear the effect of the diversion of water from the river for power purposes, and indirectly these attacks have a tendency to injure both power companies. Since the opinion of the attorney-general that the Schoellkopf company had no right to take water from the river (although we have a very strong charter and the express right from the state to take the water to the extent of 200,000 horse power), manufacturers have not always distinguished between our rights and those of the Schoellkopf company, and both companies have suffered together.

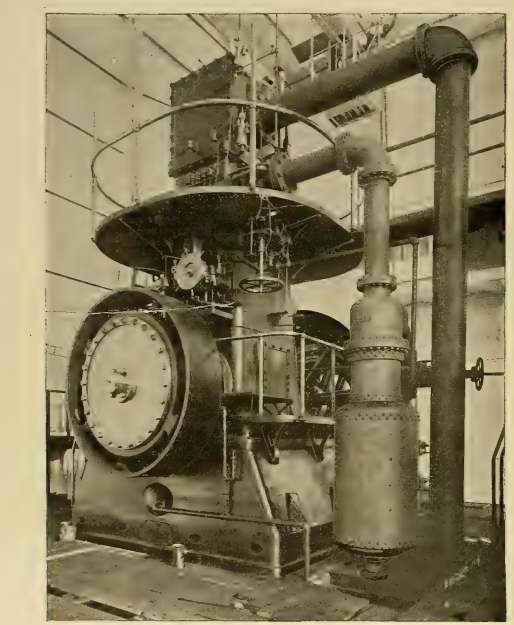
Still another bill introduced by Mr. Dudley has to do with electric power and its transmission, but this second measure makes possible its transmission from Canada. The bill is one authorizing the construction of a bridge at Lewiston and provides that the company may "lay, maintain and operate along, upon or under the said bridge gas, water and other pipes and wires, cables and other appliances for the transmission of electricity, or other motive power." Under this franchise the Canadian Niagara Power company, which holds exclusive rights for the development of power in Queen Victoria Free Park on the Canadian side might find a good customer for some of its probable power product in the Model City, the projected manufacturing city of the locality below the Lewiston mountain.

## Stratton Combined Separator and Steam Receiver.

The fall of pressure that takes place between the boiler and the engine, due to the fact that the volume of steam necessary for one stroke of the engine has to be drawn from the boiler through a long and sinuous pipe during the short period of admission which in an ordinary Corliss engine is only one-fifth to one-quarter of the stroke, has always been a source of annoyance to engineers. This reduction of pressure, as shown by indicator cards, generally amounts to from five to 10 per cent. of the boiler pressure. The use of very large steam pipes reduces the loss only in a measure, while open to the objection of increased cost, greater difficulty in keeping the joints tight, especially under high pressures, and greater liability to accidents.

In view of all this it has become the practice in large plants to place a large reservoir or receiver close to the engine, thus insuring a free supply of steam at substantially full pressure during admission, the boiler having ample time during expansion to again restore the pressure in the receiver. A receiver of this kind for high pressures has to be especially designed and exceedingly well made. Its construction cannot be entrusted to any ordinary boilermaker, as it being an engine room appliance, nicely covered and lagged, the slightest leak must be avoided. These considerations have led the Goubert Manufacturing company of New York, manufacturer of the Stratton steam separator, to design a combined separator and steam receiver. The making of the two appliances into one, while instring a supply of perfectly dry steam at full pressure to the engine, economizes space and makes a much neater appearance, as well as lessens the number of joints that would be necessary if two different apparatus were used. The large experience and manufacturing facilities of this company for high pressure work are a guarantee that nothing but good and tight work, with a safe and efficient apparatus, will be furnished.

The Goubert Manufacturing company has already supplied these combined separators and receivers to a number of large power plants. Among them may be mentioned the United Electric Light & Power company of New York, the West End Railway company of Boston and the Nassau Electric Railroad company of Brooklyn. The accompanying picture shows one of four of these Stratton combined separators and steam receivers connected to 1,200 horse power Westinghouse engines at the new power house of the United Electric Light & Power company, East Twenty-eighth street, New York city. Chief Engineer York of this company, after testing the Stratton apparatus, praises it highly.



STRATTON COMBINED SEPARATOR AND STEAM RECEIVER

## A Fireman's Curiosity Saves an Electric Light Station.

Boston was saved from the shock of a terrible explosion, the loss of many lives and much property by the merest chance, says the *Boston Herald*.

Fourteen pounds of giant powder came very near getting into one of the furnaces of the central station of the Bo ton Electric Light company on the Summer street extension.

A fireman was shoveling coal into a furnace, using one of the largest shovels, which holds perhaps 20 pounds or more of coal. The coal that is used is nearly all "slack" or dust coal, but there are occasional large lumps which are thrown right into the furnace without any thought.

The fireman had thrown a few shovelfuls into the furnace and was just about to throw another when he noticed that it was heavier than usual. He stopped, examined the shovelful of coal, found what appeared at first to be a rather large lump, but which when he brushed the dust from the surface proved to be a tin box.

"What's this?" he muttered, and he called the other fireman.

The two men then set to work and pried the box open, and found it filled with a black material that did not look unlike coaldust. The chief of the night force was then called, and the stuff in the box was found to be giant or blasting powder.

Perhaps there wasn't a sensation in that boiler room for a few moments. The box was carefully removed to a place of safety, and is now in the main office of the company.

When it is considered that there are 16 large boilers in this room, each under 140 pounds of steam pressure, the horrible results that would follow the explosion of one boiler can be imagined, for under the circumstances each and every boiler in the place would explode from the shock, and the entire building, and perhaps all of the large buildings in the neighborhood, would have been rent to pieces, in addition to the fact that fire would have undoubtedly added its horrors to the scene.

It is entirely probable that the box of powder came from the mine and was accidentally transported to the boiler room of the electric light company with the coal, but the wonder is that it did not explode owing to the rough handling to which it must have been submitted.

The company will undoubtedly investigate the matter.

Too much praise cannot be accorded the fireman who had curiosity enough to investigate a rather heavy shovelful of coal, for it is owing to his curiosity that the company has a plant on Summer street extension to-day.

## Eclipse Portable Electric Lamp.

The compact electric lamp outfit shown in the cut is designed for bicycles, carriages or other places where a portable electric light is desirable. It is made by the Eclipse Electric Lamp company of Buffalo, N. Y., and these claims are made for it:

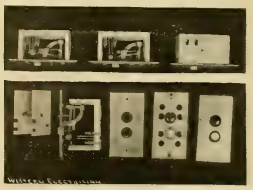
ECLIPSE PORTABLE ELECTRIC LAMP

It throws a strong brilliant light 75 to 100 feet; the most severe jolting can not put it out; wind, rain, or the speed of a bicycle or carriage do not affect it in the least; it is as far ahead and as superior to the very best oil or vapor lamp made as the electric light for general commercial use is to the oil lamps used by our forefathers a century ago, which means of course no heat, smoke or smell, no burnt fingers or soiled clothes from oil, no getting behind a tree to light matches, no jolting out and arrest (with the subsequent fines) for "lights out," but instead a light so strong and brilliant that a bicycle can be ridden with pleasure and comfort the darkest night.

The material used in making the battery solution for this outfit is known as "Eclipse electric sand," and is sold by dealers. The lamp itself, it is said, will last a season, with ordinary use. When the filament is burned out the bulb can be easily replaced. Provision is also made for replacing the zinc of the battery when necessary. The lamp outfit shown in the cut weighs one pound and is 3½ inches wide, three inches deep and four inches high.

## Painter-Morrison Push-button Flush Switch.

One of the latest novelties in the line of push-button flush switches is that known as the Painter-Morrison type and manufactured by the Morrison Southern Electric company of Baltimore. The accompanying illustration gives an excellent idea of the construction of the device and the several parts. Two of the strongest claims made for this switch by the manufacturers are its simplicity of construction and perfection of mechanism. The sides and base of the switch are of porcelain, making it fire and moisture-proof. It can be wired without taking it apart, thus saving labor and time. The finishing plate can be made to harmonize with the surrounding decorations and need not be attached until all other work is finished. The face plates are finished in brass, nickel, copper or any special finish desired. These switches are double-pole, of 10 amperes capacity, and all parts are interchangeable. They are non-arcing, easily accessible in all their parts and may be placed in groups. The buttons indicate by the touch whether the current is on or off.



PAINTER-MORRISON PUSH-BUTTON FLUSH SWITCH

### Mr. Wheeler Says the Love System Will Again be Tried In Chicago.

The latest report about the much talked of General Electric Railway company of Chicago is to the effect that the company will utilize its franchise on the South Side to put in a trolley conduit road on the Love system. A. H. Wheeler, well known to Chicagoans through the North Side loop experiment of four years ago, is the general manager of the Love company, and he is thus quoted in the *Record*:

You may say for me that the Love company has a contract to build the road. I am not at liberty to state who is behind the scheme, but we are certain of our money and know who is backing it. The owners are all in New York. Our contract calls for the building of a road first-class in all respects. The Love underground electric system will be used. The road will be the heaviest ever laid in the West, and the cars will be modeled after the Broadway cars. There will be no trailers. We shall push the work a fast as possible and finish up all we can before next winter. It will take hard work, and we already have 60 miles of road with the Love system under construction in New York. The road will run south in Dearborn street. From Harrison to Seventeenth street we will build a viaduct, and at Thirty-seventh street we will go under the tracks which are already elevated. The people of Dearborn street should be glad, for the road will be the best ever built in Chicago and will make business for the street. We want to get enough of the road done by winter to show the people that the conduit is better in winter than in summer in spite of all that has been said. We signed the contract last week, but I do not know how long the company has been formed. We will lay 21 miles of track, 10½ miles double track.

### Telephone Fight in Kansas City.

In a press dispatch dated Kansas City, Mo., March 7th, the following account of the controversy between the telephone company and its patrons is given:

A test case to prove the validity of the telephone ordinance recently passed by the City Council, establishing a rental of $9 a quarter instead of $18, was made to-day, when three officers of the Missouri & Kansas Telephone company were arrested for violating the ordinance. In the police court they were fined an aggregate of $3,600. Their bonds were furnished by the company and an appeal was taken to the Criminal Court. The telephone company claims the council's ordinance is illegal and has continued to collect former rates. Business men have generally combined to uphold the ordinance.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, March 7.—On Monday the stockholders of the Commercial Cable company held their annual meeting, and elected the following named directors for the ensuing year: J. W. Mackay, James Gordon Bennett, George G. Ward, Sir Donald A. Smith, Sir William C. Van Horne, Clarence H. Mackay, T. Skinner, G. G. Howland, C. R. Hosmer, R. Irvin, G. S. Coe, A. B. Chandler and E. C. Platt. The annual report was very satisfactory. The gross earnings in 1895 amounted to $2,009,738.14, and the working and other expenses to $794,340.53, leaving a balance of $1,215,397.61. There was an increase in the earnings of $236,304.10 and an increase in expense of $31,344.69, as compared with the previous year, resulting in an increase in net earnings of $204,959.41. Dividends of 1¾ per cent. for the quarters ended March 31st, June 30th, September 30th, December 31st, were paid, a total of 7 per cent. for the year on the capital stock, amounting to $700,000. The reserve fund was augmented by the purchase of $200,000 United States government bonds. The balance of the year's profit, amounting to $315,397.61, remained to the credit of profit and loss.

Boston furnishes the news of the latest electrical consolidation. After months of negotiation the American Electric Heating corporation of that city has gathered unto itself the Western Electric Heating company, St. Paul, Minn.; the Central Electric Heating company, New York; the New England Electric Heating company; the Burton Electric company, Richmond, Va.; the Carpenter Electric Heating Manufacturing company, St. Paul, Minn.; the Rich Electric Heating company, Mt. Vernon, N. Y.; the Dewey Electric Heating company, Syracuse, N. Y., as well as several others which have not been active in the business for some time, but which owned valuable patents. The corporation's new board of directors consists of J. Murray Forbes, president; Charles A. Morss, Jr., Edward C. Perkins, Charles L. Edgar of the Edison Electric Light company, Charles Francis Adams, second, Everett Morss, Arthur B. Smith, George U. Crocker, Ambrose Eastman of Boston, S. S. Wheeler of the Crocker-Wheeler Electric company, and Arthur M. Dodge of New York, and H. B. Scott of Burlington, Iowa. The combination will push every form of electric heating with energy and ample capital. The manufacturing will be concentrated at Cambridgeport and the head office is at 611 Sears building, Boston, with agencies here and in Chicago. James I. Ayer, ex-president of the National Electric Light association, is the general manager.

In connection with the electrical exposition, to be held in this city next May, arrangements have been made for a very interesting historical and loan exhibit, to which it is intended to devote considerable space on the main floor. A committee composed of T. Commerford Martin, Dr. Park Benjamin and E. L. Morse will take charge of this feature of the exposition. Dr. Benjamin has one of the finest libraries in the world of early books on electricity, and these will be shown in cases, arranged chronologically, with explanatory notes, portraits, autographs, etc. Mr. Morse is the possessor of an invaluable collection of telegraphic relics, curios, documents, etc., including his father's notebooks and sketches, all of which will be shown. Mr. Martin, besides owning many objects of interest connected with the early days of electricity, has secured from Mr. Tesla, Professor Thomson, Mr. Edison, Mr. Weston, Mr. Stieringer and others the loan of early and interesting apparatus, constituting a personal exhibit from each inventor.

The special commission of inquiry filed its report with the Supreme Court to-day, recommending that the proposed plan of the Rapid Transit commission should be adopted. The sense of the conclusions arrived at is summed up in the concluding paragraph of the 6,000 word report, which is: "The stimulus that it would give to our city it is almost impossible to conjecture, and, therefore, while they have given due consideration to the objections of the Broadway owners, and have not been disposed in any way to minimize them, your commissioners are of opinion and do hereby determine and report that the route proposed by the Board of Rapid Transit commissioners ought to be adopted, and that the railway determined upon by the said board ought to be constructed and operated." While the report is not final until passed upon judicially, yet, concurring as it does with the regular commission, it is pronounced a long step toward real rapid transit which will bring the Battery and Lower New York within easy distance of Harlem and the upper portions of the city by means of an underground system lying beneath the surface of Broadway. Estimates on the cost of the proposed system vary between $50,000,000 and $95,000,000. Electricity will undoubtedly be used as the motive power.

It is expected that no obstacles will be presented to the accomplishment of the big railroad deal in Brooklyn, through which, early next month, the Nassau Electric company will secure the lease of the entire Atlantic Avenue railroad system. The new company will be the Kings County Traction company, with a capital stock of $4,500,000. The deal has long been in contemplation. The Nassau company, which recently established a number of trolley lines in Brooklyn, has anxiously sought for a terminus at the bridge. The rental to be paid by the Nassau company for the Atlantic avenue system is $150,000 annually for the first two years and $180,000 annually thereafter, the whole period being 999 years. In addition to the 11 lines of the Atlantic avenue system the lease includes the roads operated by it, namely, the Brooklyn, Bath and West End railroad, the Prospect Park and Coney Island line, and the South Brooklyn and terminal lines. Within one year from date the Nassau company is to spend $500,000 for the improvement of the Atlantic avenue system, and no part of the sum is to be expended in extensions or connections other than the extension of the Bergen street line from Rochester avenue to Rockaway avenue. The Kings County Traction company is the successor of the Brooklyn Traction company, and is to receive the dividends paid by the Atlantic Avenue Railroad company out of the Nassau annual rental.

W. F. O.

### Buffalo and Niagara Falls.

BUFFALO, March 7.—The decision of the State Board of Railroad Commissioners, denying the application of the Buffalo Traction company for a certificate to construct and operate a surface railway system in this city, is still causing animated discussion. The gist of the decision is contained in the following paragraph:

Upon the testimony and after examining the proposed lines, both as a whole and in detail, and examining the needs of the city and service rendered by the existing system and other facilities, it is the conclusion of the board that the application must be denied. The applicant has not shown public need for the construction of such a substantial part of its proposed railroad as warrants affirmative action by the board. In such an application a certificate should not be refused if the application showed a public need for such a substantial part of its proposed road as would justify the construction of the whole.

The decision has aroused much bitter feeling. The *Times* says: "Language cannot be strong in denouncing the decision of the State Railroad Commission. It is not criminal because it is lawful. But it is an unprecedented disregard of citizen rights and a monstrous exhibition of indifference to the wrath of an outraged populace."

The Traction company has not given up the fight, however. When it was first known that its application for a certificate had been refused by the railroad commissioners, the company was a little at loss to know what to do. Several courses were open, and some time was necessary in which to decide what plan of action should follow. The first steps were taken when the new company filed with the city clerk the formal acceptance of the grant passed by the aldermen and councilmen and approved by the mayor. After this the new company was in a position to continue in earnest. It had a standing before the city authorities, and its next step was to fight for a reversal of the decision of the State Board. An appeal will be taken, and the Appellate Division of the Supreme Court will be asked to set aside the denial of the railroad commissioners. Not long ago the Traction people made another move. Under the name of the Elmwood Avenue & Tonawanda Electric Railway company, they asked permission of the aldermen to extend their lines through various streets in this city. The city fathers named the afternoon of February 19th as the date for the public hearing to consider the application. At the same time the aldermen condemned the Brackett bill, now pending in the Legislature, which seeks to give to the State Railroad Commission authority to pass upon extensions of established lines, as well as the necessity for new roads. The injunction proceedings against the city and the Traction company were sent to the corporation counsel with instructions to defend. Though the extensions asked for practically cover the same ground as those in the former application of the company, many changes are made in the route. Streets which were formerly included are left out, while new ones are added.

The State Board of Railroad Commissioners held a recent session in Niagara Falls to take testimony upon the application of the Niagara Falls Electric Railway company for a franchise to construct and operate an electric railroad in the eastern and northern sections of the city and upon Niagara street. After listening to several witnesses, the commissioners adjourned for a further hearing in Albany at a later date.

In the village of Medina, Orleans county, the electric lighting controversy is still unsettled. The present contract expires in April, and the company's bid is so much higher than the present contract that it is probable that the board of trustees will refuse to make a new contract, and that the town may go unlighted for a considerable period unless the people of the village express a desire to settle the matter themselves at a public meeting, which will probably be called soon by the president of the village. The electric fire-alarm system, which has practically been contracted for, is to a greater or less extent waiting for the decision respecting electric lighting, as the Electric Light company's poles are the most desirable to use for the wires of the alarm system. Whoever gets the lighting contract will probably have to give the use of the poles for the alarm system, but in advance of such a decision neither the village officials nor the fire-alarm contractors feel like taking the risk of stringing any wires.

At a recent meeting of the Common Council of the city of Lockport, Mayor Atwater appointed H. M. Whitbeck, J. W. Dumville, Jr., and F. N. Trevor as a committee to consult with the Niagara Falls Power company and endeavor to ascertain the possibility of furnishing Lockport factories with reliable electric power, and at what price. Lockport is the county seat of Niagara county. It has a population of about 16,000. The majority of its factories have been securing power by the use of water from the Erie canal, but a short time ago the water was let out in order to facilitate the work of a survey preparatory to extensive improvements. Then the Manufacturers' association arranged to throw a dam across in order to secure a temporary supply of water. It is, however, recognized that the factories will not long be permitted to use canal water; therefore the desire is to secure power from the Falls. The distance between Niagara Falls and Lockport is about 19 miles, and if it be possible to

successfully transmit power from the Falls to Buffalo, Lockport stands the same chance of being benefited. There is no doubt that the Niagara Falls Power company will gladly supply Lockport with power, providing sufficient business is offered to support a transmission line.

The new addition to the plant of the Carborundum company is having the roof put on. This new building is of brick and two stories high. In it are two fine large pottery kilns, and it will not be long before this company is doing all of its business at the Falls.

The Fitzsburg Reduction company's plant on the Niagara river continues its steady product of aluminum. Men are building the foundation for the new rotary transformer it is proposed to install, and soon the work of remodeling the four rotary and the static transformers now in use will be commenced. This task will be finished in May in all likelihood. This will give the machines a capacity of 600 instead of 400 kilowatts, or about 787 horse power, as compared with the present 525 horse power.

In the calcic carbide plant all is activity. The General Electric company's force is hard at work installing the electrical machinery, and finishing touches are being put on the plant here and there. This factory will commence operations very soon.

The new sodium plant is beginning to assume its proportions. This factory is the farthest of any of the new plants at Niagara Falls from the power house. One of the frame buildings is up and the other is going up rapidly.

The Common Council of Lockport has passed a resolution favoring the submission to the Legislature of a bill allowing that city to issue $40,000 worth of 4 per cent. bonds for the purpose of establishing a municipal lighting plant. The city's present contract expires next year. The people have already approved the step.

In the event of the Niagara Falls Power company not deeming it advisable to run a transmission line to Lockport, there is a possibility that Niagara Falls will secure some of the factories now located there.

The Cowles aluminum plant in Lockport, which was closed some time ago in consequence of litigation with the Pittsburg Reduction company, still remains in that condition so far as the manufacture of aluminum is concerned. Mr. Cowles has turned his attention to experiments in making acetylene gas.

The Niagara Falls & Buffalo Electric Light & Power company will soon install the machinery that will make it possible for it to take current from the big generators of the Niagara Falls Power company. This company supplies the electric light for public use in Niagara Falls as well as supplying private customers. It has recently increased its capital stock from $100,000 to $200,000.

By March the Cliff Paper company expects to be making paper by electric instead of steam power. This company is very enterprising and was the first to enjoy a double use of water on the high bank at Niagara Falls.

After many months of negotiation, it has been settled that the Massey-Harris company will establish the United States branch of its business at Niagara Falls. This company manufactures agricultural implements, and has plants of some magnitude in Toronto, Brantford and Woodstock, Ont.

The directors of the Niagara Falls Power company have decided to at once invite proposals for the poles to be used in the power transmission line to Buffalo. The contract is likely to be let so that work can be begun early in the spring. However, Buffalo stands no chance of securing Niagara power this year, for before this will be possible the wheel-pit extension will have to be completed. P. D.

## Washington, D. C.

WASHINGTON, March 7.—The following bills, which will prove of interest to electricians, have been presented to Congress during the last few days:

Senator Pugh of Alabama has a bill before the Senate authorizing the private use of the water power of the Coosawwee in Alabama to H. G. McCall and his associates for the purpose of generating electricity, and for manufacturing purposes.

Representative Hooker of New York has presented to Congress a bill to amend an act to authorize the Interoceanic Railway company to construct and operate railway, telegraph and telephone lines through the Indian Territory.

A bill to protect state anti-gambling laws from nullification through inter-state gambling by telegraph telephone or otherwise has been introduced in the House by Representative Gillett of Massachusetts.

Representative Cloud of Iowa has a bill in Congress extending the time whereon the Des Moines Rapids Power company shall begin work one year.

Senator McMillan of Michigan has introduced a bill in the Senate authorizing the laying of subways in the streets, roads, avenues and alleys of the District of Columbia, and providing for placing the present overhead wires therein. The bill has been referred to the committee on the District of Columbia.

Senators Proctor and Bacon gave a hearing to advocates of a bill introduced in the Senate by Senator McMillan to incorporate the Columbia Telephone company. Appearing in the interest of this bill was Maj. Butterworth, John A. Baker, T. A. Lambert, T. C. Daniel and W. G. Wasaman.

Senator McMillan of Michigan has introduced a bill in the Senate to authorize the extension of the lines of the Potomac Light & Power company, a corporation now engaged in the business of selling electric current for various purposes in the District of Columbia and in the state of Virginia. The bill has been referred to the committee on the District of Columbia.

The friends of Daniel Drawbaugh were given a hearing by the Senate committee on patents recently. Mr. Drawbaugh claims to be the original inventor of the microphone. His application was thrown out of the Patent Office on the ground that a device of the same character had been in use two years when he asked for a patent. Mr. Drawbaugh's friends are making an effort to secure legislation whereby he may be allowed to proceed with his application for a patent. The probability of an early decision by the United States Supreme Court on the validity of the Berliner patent adds interest to the Drawbaugh move.

A bill was introduced in the Legislature of Maryland yesterday for the consolidation of the four electric railroad companies that have secured the privilege of constructing lines between Baltimore and this city. The move for consolidation is said to be part of the scheme for the construction of an electric railroad system from Washington through Baltimore to Westminster over the Blue Ridge to the Cumberland Valley and Gettysburg. Widener and Elkins and other capitalists interested in railways are said to be connected with the project.

An electrical expert has been appointed by the District commissioners to serve on the commission for the revision of the building regulations, to fill the vacancy caused by the death of W. P. Freeman. Commander Washburn Maynard, U. S. N., has been selected for the position, because of his reputation as an electrical expert, and he will be asked to revise that portion of the new regulations concerning electricity in large buildings.

A bill has been introduced in Congress by Representative Quigg of New York, to provide for the extension of letters patent for an "improvement in insulating submarine cables." The extension is asked to be granted to Baker A. Jamison and Tallmadge A. Lambert, administrators *de bonis non* of George B. Simpson, for the term of seven years, upon payment of the usual fees and charges for the extension of patents.

President Phillips of the Metropolitan road states that the business of the Ninth street line has increased 100 per cent. since the installation of the electrical system. T. M.

## Northwestern Notations.

MINNEAPOLIS, March 7.—The city of St. Paul has awarded the contract for lighting the business part of town with electricity to the St. Paul Gas Light company at $69.50, and the rest of the city with gas.

The Hartman General Electric company of Duluth has been reorganized as the Commercial Light & Power company, and the capital stock increased from $500,000 to $1,000,000.

The car barn of the Marshalltown Light, Power & Railway company was damaged by fire, one motor car being burned and several others damaged; loss $6,000.

The Superior-Cloquet Electric Railway company has been incorporated at West Superior, Wis., to build a line to Cloquet, Minn. Considerable traffic is expected to Spirit Island, where a summer resort will be fitted up.

The Ironton Structural Steel company of Duluth has awarded the contract to the Westinghouse Electric & Manufacturing company of Fittsburg for furnishing electrical apparatus to furnish power to handle two 25-ton traveling cranes.

The proposition for the town to own an electric light plant at Mt. Pleasant, Iowa, was defeated at the late election.

The Lidgerwood electric railway in Spokane, Wash., will be extended to Hillyard as soon as possible.

The opinion entertained by citizens of Mankato, Minn., in general, and the aldermen in particular, of "L. E. Walkins, C. & E. Eng., 50 Court street, Boston, Mass.," is anything but flattering. The town has been trying to secure lower rates for electric lighting and also wants an electric railway. Some time since plans were prepared for a municipal electric plant, but the bids were considered too high and were rejected. The town then advertised for bids for lighting the city, operating an electric street railway, etc. Walkins offered to furnish arc street lamps at $57.60 per annum, and to put in the electric railway. He said he was putting in a similar plant at Madison, Ind., and mentioned several business men of the East who were interested with him. The council accepted the bid, and wrote to some of the men mentioned, and to Madison, Ind. The city clerk of the latter place denied that Walkins is putting in such a plant. The business men named do not know of the plan, or are not men of means. A Boston attorney thinks Walkins' scheme is to get a franchise, borrow money on it, and get out from under.

The Ashland Lighting & Street Railway company's plant was sold under foreclosure for $175,000, and the new company incorporated by Charles Quarlesof Milwaukee, R. C. Heydlauff and A. E. Kanneburg of Ashland.

An ambitious trolley scheme is proposed at Niobrara, Neb., utilizing water power from artesian wells to build a line to Verdigris, 12 miles, and connect with the Elkhorn road. The estimated cost is $25,000. There are three or four other points of 15 to 20 miles distance which it is proposed to connect with in the future.

A bill has been introduced in the Iowa state Legislature requiring that all electric cars be vestibuled and have a double set of brakes, to work singly or double, and placing street car companies under the control of the railway commissioners. Forfeiture of charter is the penalty for violation of the law. C.

## PERSONAL

Superintendent Frank Stevens of the Electric Protection company of Philadelphia is not only a successful electrician, but he is also proficient in the political arena. A flattering notice of his election as councilman from the Twenty-fourth ward in Philadelphia appeared recently in a paper of that city. The fact that his majority was one of the largest given to any councilman elected indicates that his popularity is not confined wholly to the electrical trade.

## ELECTRIC LIGHTING.

It is stated that the water power and steam electric lighting plant at Elkhart, Ind., is for sale. O. N. Lumbert of Syracuse, N. Y., can give information.

A recent issue of *Engineering* of London contains a long and appreciative descriptive article, well illustrated, of the Harrison street station of the Chicago Edison company.

## ELECTRIC RAILWAYS.

The Fox River Valley Electric Railway company, which operates the street car lines in old Green Bay, Wis., will extend its lines across the bridges to the former Fort Howard, having acquired the plant on that side. It has also just completed arrangements to extend its line to the village of Depere, five miles south of the city. The extension will cost $35,000 and will probably prove the nucleus for a line taking in the whole of the Fox River valley to Neenah and Menasha, and possibly to Oshkosh.

A contract was signed on March 5th in the City of Mexico for the sale of the street railway system belonging to the Federal District company, the price paid being $7,750,000, of which $100,000 cash was paid on signing of contract, $825,000 to be paid in cash in May, and the same amount in the month of July, and the remaining $6,000,000 to remain as a mortgage at six per cent. The buyers are London and South African capitalists, who are said to contemplate other large investments in Mexico. The present capitalization of the company is $6,500,000, and pays seven per cent. The new owners will introduce electricity and modernize and improve the system.

## MISCELLANEOUS.

At the regular meeting of the Engineering Association of the South, at the headquarters in Nashville, Tenn., held on March 12th, William Hewitt read a paper on "Some Problems in the Bending of Wire Ropes."

A recent statistician states that the United States Patent Office has issued 3,075 patents for inventions, contrivances and discoveries in telegraphy, while over 16,000 patents have been issued for electrical appliances.

Jesse Tacey, 55 years old, and his son Jesse Tacey, Jr., 24 years old, were killed a few days ago by grasping a live wire that they found in a garden near their home in Thornton, a village about two miles out of the city of Providence, R. I. The wire was an old telephone wire that had been dangling from the pole for several days in the way of passers-by, one of whom picked up the end and threw it over the bars of Tacey's barnyard. The

wire crossed an electric light wire, and rubbing through the insulation, became charged with a powerful current

F J. Nash of Nyack, N. Y., sends to the *Insurance Press* of New York a suggestion for long-distance electric transmission by which the line will consist of iron pipe conduit containing the conducting wires and silex as an insulating medium. This is the process An iron pipe, treated so as to render it impervious to moisture, is used as the retaining covering, or outer conduit. Within this pipe is placed the ordinary copper conductor wire. The space between the copper wire and the iron tube is filled with pulverized silex closely packed and the ends of the tubes connected with tight joints.

Lieutenant Swift of the Ninth Cavalry, United States Army, who committed suicide at Fort Robinson, Neb., was one of the most skillful telegraph operators the world has ever known. He was able to do a number of fancy tricks in sending and receiving messages. One of them was to take two messages at the same time. He could write equally well and beautifully with either hand, and could take a message from one instrument, writing it out with his left hand, while he copied another message with his right. He could also send a message with one hand while he received another message, copying it with the other hand.

A Mexican national exposition of industries and fine arts, with an international department, will be opened in the City of Mexico, September 15th, to continue for at least six months. England, Germany, France and the United States, it is expected, will be worthily represented by exhibits of manufactures. Four main buildings will be provided for the housing and display of products from the United States; for manufactures, mechanical arts, agriculture and food products. There will be an international exhibition in Belgium in 1897. It will comprise 14 sections, of which one will be devoted to lighting and heating and another to electric traction.

## TRADE NEWS.

Bowers Brothers of 117 and 119 Lake street, Chicago, miners and importers of mica for electrical purposes, issue a standard price-list, which will be useful to the trade. Mica is furnished uncut, in stamped sheets or cut to any size. Billings & Spencer commutator segments of copper are also supplied by Bowers Brothers.

The Metropolitan Electric company reports recent large sales of P. & B. tape and compound; the spring construction has begun rather early. The Metropolitan Electric company is fortunate in having this agency, and has increased the business West since it has been in its hands very considerably. It is also receiving good orders for Ship cored carbons.

Thomas F. O'Connor, who has been nine years connected with the Standard Underground Cable company, has just resigned from that company to accept the position of assistant general manager of the National Underground Cable company. Mr. O'Connor has been in the underground cable business from its infancy; has seen it grow to its present proportions, and has aided much in that growth. Outside of his broad experience in the underground cable business, in which he is an acknowledged expert, Mr. O'Connor is well known as an inventor in mechanical as well as electrical branches.

J. E. Rhoads & Sons, 239 Market street, Philadelphia, have added to their already large stock of oak-tanned belting another style of belt. It is high grade, medium weight, short-lap, oil-treated and rivetless. This they have put in stock in response to frequent calls for a high-speed belt. It is their Diamond State brand Rhoads & Sons have recently made tests of their belting in comparison with some other high-grade makes, which clearly show that their gilt-edged short-lap belt is the peer of the very best brands, both for tensile strength and minimized stretch. The firm is sparing no pains to maintain the standard of the Rhoads belt as one that will give sure satisfaction to all belt users.

The Interior Conduit & Insulation company of New York advocates the use of interior conduit in the wiring of electric cars. The method consists of a system of insulating waterproof and electrically fire-proof tubes which may be concealed in the framework of cars after the manner of gas pipes. These tubes are run from roof of car to motors, controllers and all lamp outlets in the car, thus making a complete insulated race-way for all wires. The dangers resulting from the accidental overheating, or, perhaps, melting of wires, and the consequent liability to destruction from fire, is eliminated by the use of this system. The wires are perfectly accessible at all times, and in the event of the failure of any circuit from any electrical derangement the defective wire may be withdrawn and a new one substituted in its place without removing the woodwork or defacing the interior finish of the car.

## BUSINESS.

Frantzen & Bennett, electrical contractors of Chicago, dissolved partnership on March 3d. Mr. Bennett is no longer connected with the firm. The business will be continued by Arthur Frantzen at the same location, 353 Dearborn street.

The baby knife switch has leaped into public favor with about the same rapidity that the new baby usually does. The Electric Appliance company is meeting the demand for this new specialty by carrying a large stock at very low figures. These switches are furnished with round or square bases, in 15 and 25 ampere sizes, single and double pole.

The Columbia pad calendar for 1896 has made its appearance, representing the eleventh annual issue, and, handy and convenient as it has been heretofore, the new issue certainly surpasses any of its predecessors. The new calendar contains a much better arrangement than in previous years, more space having been allowed for memoranda, while a greater charm has been added by liberal illustration and a unique and convenient grouping of dates, calculated to meet the hurried needs of business men. This calendar is issued by the Pope Manufacturing company of Hartford, Conn.

The National Underground Cable company has just received from the Central Union Telephone company a large contract for telephone cable for the city of Toledo, the contract covering also the laying, jointing and connecting of the cables, etc. This is said to be about the largest single telephone cable order given out in the year 1896, and the National company is proud of it. This progressive and enterprising company has also booked within the week several large orders for electric light and street railway cables and is rapidly making itself felt in the line of telegraph cables, for the manufacture of which it has a special department in its factories at Harrison, N. J.

The F. J. Pearson Manufacturing company, Security building, St. Louis, Mo., has recently brought out a line of new electrical appliances, among which is an improved dry battery known as the "hang-up" dry battery It is claimed for this battery that the provision for hanging up practically does away with the necessity for shelves or boxes It is convenient to install; is out of the way, and cannot upset, to cause trouble The square form of this battery is a great convenience in packing There will undoubtedly be a brisk demand for these batteries, especially as the manufacturers state that they are in position to put them on the market for less than is asked for other dry cells

H. E Collins & Co , Bank of Commerce building, Pittsburg, Pa , sole sales agents for the Cahall vertical water tube boiler, manufactured by the Aultman & Taylor Machinery company, Mansfield, Ohio, report the following sales of Cahall boilers made within the last few days. Pittsburg Plate Glass company, Kokomo, Ind , 1,000 horse power; Brown & Co , Pittsburg, Pa , 100 horse power; Jones & Laughlins, Pittsburg, 500 horse power The boilers for the Pittsburg Plate Glass company are of the Standard direct-fired type, those for Jones & Laughlins will be equipped with the chain grate stoker, and the battery for Brown & Co. is of the waste heat type.

In recommending the use of high-grade carbons for arc lamps, Hugo Reisinger of 38 Beaver street, New York, says: "I am convinced that if consumers of arc light carbons will only make a careful test of the carbon they are using against the 'Electra' carbon, they will discover that, taking the candle power produced at an expenditure of a certain amount of current, with life, steadiness and dust as important factors, the high-grade 'Electra' carbons will be by far more economical than any other carbon, foreign or domestic, manufactured, or putting it more plainly, the 'Electra' carbon will cost less per given hours of burning than any other carbon which may be listed at a lower price." Samples are sent for testing free of charge.

The Morrison Southern Electric company of Baltimore, Md., is rapidly taking a position in the front rank in the manufacture of electrical apparatus, and in fact it is the largest concern of its kind in the South. The offices and retail store occupy the first and second floors of the double store in the Hoen building, and they carry a stock which would meet the average want of most any purchaser of electrical goods. The factory is located at 212 and 214 Holladay street, which, although a large building, is somewhat crowded in meeting the calls upon the company of late because of increasing business. On the first floor of the factory building are located the winding room and foundry. Special machinery is used in many places, the most important being a converter press, which is one of the few successful machines in this line of work. The second floor is occupied as an assembling room, electroplating, buffing room and stock department. The third floor is filled with a splendid assortment of special tools and machinery to use in the varied work which is taken up by this concern. The Morrison Southern Electric company is undoubtedly the headquarters for repair work in its vicinity. No less than 100 hands are employed continually, and of late night work has been necessary. General Manager J. S. Boyd is the right man in the right place. Through his careful organization this concern has, from a small position in the electrical trade, assumed large proportions, and he reports that the company is at present at work upon a large number of electrical novelties which will be offered to the general trade soon.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued March 3, 1896.*

555,487. Closed Conduit Electric Railway. Chris Anderson, Leeds, England. Application filed March 1, 1894.

In this railway an underground conductor is employed, together with vertically movable contact pegs adapted to complete the circuit between the conductor and a car, a ramp being carried beneath the car adapted to operate mechanism for raising and depressing the pegs to make and break the circuit.

555,488. Closed Conduit Electric Railway. Chris Anderson, Leeds, England. Application filed February 13, 1895.

The inventor claims: In apparatus for operating electric railways from an underground electric supply cable, the combination of a series of vertically movable contact pegs adapted to complete the circuit between the car motor and the electric supply cable, a series of vertically movable mechanical pegs, each provided with a stud or cross-arm that carries one of the contact pegs, a series of boxes arranged at intervals for containing the pegs, lever mechanism located in each of the boxes, a link having its lower end connected to the lever mechanism and its upper end connected to the stud or cross-arm that connects a mechanical peg and a contact peg, connections from the lever mechanism in each box to the similar lever mechanisms in adjacent boxes, and a ramp carried beneath a car to engage a raised mechanical peg and cause the depression of the pegs in one box to elevate the pegs in the next forward box.

555,491. District Alarm System. Max E. Barrett, Chicago, Ill. Application filed April 16, 1895

In this invention two conductors are employed, extending through the district to be protected, each conductor being closed upon itself. The signaling boxes or instruments are connected in multiple between the two circuits, and a battery and responsive device at the central or signal receiving station are connected in a bridge between the circuits. When circuit is closed through any signal box two paths for the battery current are provided, each of the round circuits affording two paths between the battery and the signal box. If one of the round circuits be opened at any points the battery will find circuit through the other limb of the particular round circuit, which is open. If both of the round circuits are open the battery circuit will find a path over the unbroken limbs of the two circuits.

555,503. Controlling Mechanism for Electric Motors. Lucius T. Gibbs, Milwaukee, Wis. Application filed January 2, 1896.

This mechanism embodies the combination of a manual switch lever controlling resistances in the armature circuit, a concentrically pivoted switch arm controlling the armature circuit, stops for limiting the movement of the switch and arm, a spring connecting the switch and arm and tending to draw them together when the lever is turned in either direction out of line with the arm, and an electromagnet arranged to hold the arm against the tension of the spring in position to maintain the armature circuit while the normal current passes through the field.

555,509. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Application filed June 21, 1894.

Poles arranged upon opposite sides of the street are employed, two parallel railway tracks being arranged in the street, a span wire formed in two parts insulated from each other, being connected at its ends to the poles: a positive working conductor is suspended from one of the sections of the span wire and above one of the tracks, while a negative working conductor is suspended from the other section of the span wire and arranged above the other track, the object being the substantial elimination of the tracks and earth as the return conductor, the tracks being used as bridging media between the positive and return conductors of the electric railway.

555,511. Method of Converting Potential Energy of Carbon into Electrical Energy. William W. Jacques, Newton, Mass. Application filed June 5, 1895.

The process consists of converting the potential energy of carbon or carbonaceous material into electrical energy by chemically combining oxygen with the carbon or carbonaceous material through an intervening electrolyte.

555,529. Electrically Propelled Cars. Edgar Peckham, New York, N. Y. Application filed June 11, 1895.

The first claim reads: The combination with an electric motor pivotally connected at one end of the axle of the truck, of longitudinal motor hangers pivotally connected between their ends to the sides of the motor and supported at each end from the frame of the truck.

555,544. Dynamo-electric Machine and Electric Motor. George A. Wells, Jr., New York, N. Y. Application filed April 12, 1895.

The novel combination is: A single coil multipolar magnet provided with arms radiating from the core at either side of its coil and terminating with U-shaped pole pieces alternating in sign and lying in a plane concentric with the axis of the machine, to thereby co-operate with an armature constructed to register therewith and be embraced between the opposite faces of the U-shaped pole pieces.

555,546. Electro-magnet for Separating Metal. H. H. Whitacre and A. C. Wolfe, Wellsville, Ohio. Application filed March 1, 1895.

The claim reads. In a hand manipulated magnetic separator, the combination of a series of magnets radially disposed about and parallel with a central axis, core extensions of the magnets coincident with the central axis of the separator, radially disposed intermediate pieces connecting the core extensions and the series of magnets, a coil surrounding the core extensions and abutting against the radial intermediate pieces, a hermetic jacket inclosing the coil, a handle secured to the core extensions and projecting axially beyond the coil and the magnets, and wires leading from the end of the handle.

555,571. Trolley Pole and Connection. Charles H. Finson, Pittsfield, Maine. Application filed July 20, 1895.

The invention consists in the following combination of elements, a tubular trolley pole swinging vertically from a standard, a toothed frame secured to the standard, a pawl pivotally hung from the trolley pole, a trolley truck pivoted to the pole near its upper end, a cord or wire having its lower end connected with the pawl and extending up through the pole, and mechanism connected with the cord and intermediate therewith and with the truck, whereby the cord is tightened and the pawl held out of engagement with

the toothed frame when the trolley is in contact with the under side of the wire, and the cord is loosened and the pawl placed in engagement therewith when the trolley slips off the wire.

555,581. Engraving Machine Barton S. Molyneux, Minneapolis, Minn. Application filed March 1, 1894.

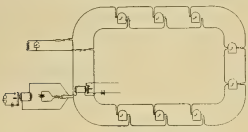
The first claim is given The combination with a graver or drill of an electric motor, with the motor armature and the drill on a common shaft which is free for sliding movement in fixed bearings.

555,585. Safety Appliance for Electric Brakes. W. B. Potter, Schenectady, N. Y. Application filed April 22, 1895.

This appliance consists of a braking switch, a circuit including the braking switch, brake magnets, and a source of electromotive force, a solenoid, contacts normally short-circuiting the solenoid, a core for the solenoid controlling the braking switch, a magnet in the circuit controlling the short-circuiting contacts, and means for adjusting the magnet for different amounts of current.

555,589. Electric Meter. Georg A. J. Telge, Oldenburg, Germany. Application filed April 21, 1895.

This meter consists of a pair of normally synchronous indicators and a device under control of the current to be measured, having oppositely working regulating connections with the indicating mechanism for adjusting them simultaneously in opposite directions, and thus differentiating their readings proportionately to the controlling current.



NO. 555,491.

555,590. Monocyclic Generator. Elihu Thomson, Swampscott, Mass. Application filed March 29, 1895.

This generator comprises a main armature and field magnets generating single-phase alternating electromotive forces, a teaser armature upon the same shaft having a separate core from the main armature and provided with field magnets and adapted to generate an electromotive force of displaced phase, and separate means of regulation for the two armatures.

555,601. Electrical Railway Signal. Wilhelm Fiedler, Charlottenburg, Germany. Application filed August 25, 1894.

The inventor claims: The combination of a semaphore-arm, a rod, a rotary disk, an eccentrically-placed pin in the disk, in connection with the rod, an electric motor, a wheel train adapted to be revolved by the motor and to communicate the rotary motion thereof to the disk, a ratchet wheel and pawl interposed in the wheel train for permitting further rotary movement of the disk, on arrest of the motor, an arm and a pin adapted to move with the wheel train, a three-arm lever adapted to co-operate with the arm and pin, a circuit containing the motor and operating key at the place of control and a contact under control of the three-armed lever, a branch circuit, an electro-magnet in the branch circuit, an armature thereto and a hook adapted to be operated by the armature to arrest the three-armed lever.

555,621 Electric Arc Lamp. Rupert Schefbauer, Hoboken, N. J Application filed August, 8, 1895.

A fly-wheel is connected by a ratchet and pawl to a shaft with pinions that are rotated in the movement of the carbons, and the electro-magnet that is in the main line circuit acts in a peculiar way by a clamp upon the fly-wheel in drawing the electric arc, and when the carbons are moved to a certain point as they are consumed, the current is short circnited through a resistance corresponding, or nearly so, with the resistance of the carbons and arc, and in case of a carbon breaking the current is automatically switched through a shunt so that the current on the line is not interrupted; but when the circuit through the carbons is restored the shunt is automatically broken.

555,620. Fac-simile Telegraphy Alfred W. Storm, Ramsey, N. J. Application filed September 11, 1895.

In this system of telegraphy a message sheet of suitable fabric is employed having a design partly of non-conducting and partly of conducting substance thereon, in combination with a telegraphic transmitter having a circuit-closer with adjacent contact points and means for moving the contact points across the message sheet, and electrical connections to the points adapted to close a circuit through the points and through the conducting substance of the design.

555,628 Armature for Dynamos and Motors. George A Welles, Jr , New York, N Y. Application filed April 12, 1895

The third claim reads: A ring armature for a dynamo or motor built up in segmental sections and provided with coils so placed thereon that spaces are left on the outer periphery thereof.

555,634. Trolley Protector for Firemen. John P Barrett, Chicago, Ill. Application filed December 13, 1895

The trolley wire of an electric railway system in the neighborhood of a fire is rendered inactive by inserting a [illegible] between the trolley wire and the track, whereby a [illegible] provided between the trolley conductors and the return circuit through the rails, the fuse at the central generating station being thereby blown out.

555,645 Telephone Call Registers Heinrich Hempel Berlin Germany Application filed April 9, 1895

A conversation indicator for telephones characterized by a bolt the point of which [illegible] highest position engages [illegible] the ringing crank axle, and the pin of the bolt [illegible] connected with counting mechanism [illegible] upward or downward movement [illegible] movement of the counting mechanism [illegible] to indicate the number of connections made for the purpose of conversation, while a pin [illegible] the bolt [illegible] connected with a lever [illegible] and pin that on pressing down the bolt the pin rests [illegible] lever arm, and on the upward movement [illegible] induced by the hanging of the receiver.

the other lever arm and with it the bolt is pressed up, and by this means the further turning of the crank is prevented.

555,674. Trolley Head. W. H. Carr, Bath, Maine. Application filed October 15, 1895.

The combination of the rod having the threaded end, the head having the socket to receive the end, the flat flexible plate secured to the head and having one of the securing bolts engaging the threads in the end of the rod, the trolley carrier pivoted on the head, ball bearings between the head and carrier, the trolley mounted in the carrier, the ball bearings for the trolley, and the spring having one end connected rigidly to the front of the head and the other end loosely engaging the front of the trolley carrier.

555,702. Electrical Measuring Instrument. A. H. Hoyt, Penacook, N. H. Application filed June 10, 1895.

In an electrical measuring instrument comprising the combination with the stationary member, of a movable member, a spring arm forming the sole support and guide for the movable member, and a pointer connected with the movable member and adapted to travel over a graduated scale.

555,706. Electric Arc Lamp. Erwin Lavens, New York, N Y. Application filed May 23, 1895.

An arc lamp, comprising the combination of a movable carbon support, a shaft carrying a wheel or drum from which the carbon support is suspended, a clutch wheel mounted on the shaft, a gravitally-acting armature which normally overcomes the weight of the carbon support, a dog or dogs so pivoted as to move eccentrically to the axis of the armature, a magnet for moving the armature, and a stop against which the dog or dogs strike when the armature in its movement reaches a predetermined point, thereby acting to release the carbon support and permit the upper carbon to feed.

555,707. Signaling Circuit. J J. O'Connell, Chicago, Ill. Application filed December 23, 1895.

This invention relates to signaling between the stations of an electric circuit and comprises a system in which the signal-sending appliances at one station, when actuated, remain in their working position, effectuating the continuous giving of the signal at the other station until the attendant at the latter station takes proper action in response thereto.

555,725. Party Telephone Line Apparatus. Angus S. Hibbard, Chicago, Ill. Application filed September 16, 1895.

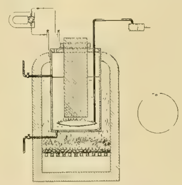
Means are provided whereby a number of telephone sets may be connected upon a party line, selective signals being adapted to be sent over the line to ring the bell at one substation without affecting the remaining bells. A bell or call device is provided at each of the sub stations, the bells at two of the sub-stations being connected between one limb of a metallic circuit and ground, one of the bells being adapted to respond to currents sent over the line in one direction, while the other bell is adapted to respond to currents sent over the line in the opposite direction. The bells of the other two stations are connected between the opposite limb of the metallic circuit and ground, one of the bells being constructed to respond to current sent over the line in one direction, while the other is constructed to respond to currents sent over in the opposite direction. At the central stations are provided two generators, one adapted to send current over either of the limbs in one direction, while the other is adapted to send current in the opposite direction.

555,777. Car Fender. John Kerrigan, Philadelphia, Pa. Application filed January 8, 1896.

A car fender, consisting of a stationary frame, a movable member attached thereto, a trap movably mounted upon the stationary portion, a ratchet-and-pawl mechanism also mounted upon the latter, connections from the trap to the mechanism, and springs and suitable connections for holding the member in position.

555,792. Method of and Apparatus for Magnetic Separation. John P. Wetherell, South Bethlehem, Pa. Application filed February 10, 1896.

A method of magnetically separating substances of relatively very low magnetic susceptibility from mixture containing them, which consists in establishing a magnetic circuit, concentrating the magnetic circuit across a working area and developing therefrom intense magneto-motive forces sufficient to inductively magnetize such particles of very low magnetic susceptibility, subjecting the mixture to the action of the intense magneto-motive forces and thereby attracting and withdrawing from the mixture the particles to be removed, and progressively removing the withdrawn particles from the field of action of the intense magneto-motive forces.



NO 555,511.

555,793. Separation of Franklinite Ore and Metallurgy Thereof. John P. Wetherell, South Bethlehem, Pa Application filed February 10, 1896

A method of separating paramagnetic materials of different permeability, from mixtures containing them, which consists in subjecting the mixture to the action of a magnetic field sufficiently condensed to remove the paramagnetic material and then separating the removed paramagnetic material into its components by subjecting it to the action of a magnetic field reduced in intensity sufficiently to leave the less permeable component, but sufficient to remove the component of higher permeability.

555,794 Magnetic Separator John P Wetherell, South Bethlehem, Pa. Application filed February 10, 1896

A magnetic separator, an electro magnet having a pole piece tapering toward its free end the free end being of less sectional area than the magnet core, so as to highly condense the lines of magnetic force, an ore conveyor below and in close proximity to the tapering end and conveying the ore through a portion of the highly concentrated field.

the tapering end of the pole-piece being arranged transversely to the direction of travel of the conveyor and a second conveyor for withdrawing the attracted particles.

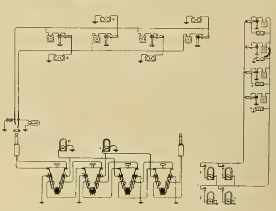
555,800. Electric Railway System. Andrew J. Beikzel, Boiling Springs, Pa. Application filed April 15, 1895.

A series of switches electrically connected, contact points extending from the plate of the switch to the surface of the roadbed, a contact lever connected with a transversely extending rod with its ends alternately protruding into the grooves of the rails on opposite sides of the track, and means at the front and the rear of the car for operating the rods.

555,841. Electric Arc Lamp. Thomas E. Adams, Cleveland, Ohio. Application filed June 6, 1895.

In an electric arc lamp, the combination with the carbon rod and a clutch having jaws disposed at diametrically opposite sides of the carbon rod, of graphite facings on the jaws, the graphite facings being thus adapted to receive the carbon rod between them and engage the same at diametrically opposite points.

555,846. Bond or Connector for Electric Railways or other Electric Conductors. Antoine Bournonville and John J. Zimmele, Philadelphia, Pa. Application filed September 20, 1895.



NO. 555,725.

A bond or connector for an electrical conductor formed of a bar having a body half-round or segmental in cross-section and an end reversed on itself forming a divided head which is adapted to be spread apart

555,847. Timing Apparatus. George F Brackett, Jersey City, N J Application filed March 14, 1895.

The combination with a time movement, of time movement stop mechanism and separate time movement start mechanism connected in an electric circuit, the circuit being closed by the operation of the time movement.

555,850. Core and Coil for Dynamo-electric machines Abe L. Cushman, Concord, N. H. Application filed August 29, 1894.

An inductive core provided with recesses having straight parallel sides, tapering divisions or teeth, the faces of which are narrower than their base, coils or windings, all of equal length and adapted to fill the recesses, and retaining rings for supporting the coils, all so arranged as to produce a field as nearly as possible mutual throughout and of high magnetic efficiency.

555,851. Armature for Induction Motors. Abe L. Cushman, Concord, N. H. Application filed April 13, 1894

The inventor claims an armature for induction motors, having some of its coils connected irregularly at opposite ends and in closed circuit with short circuit rings at each end of the armature and others in multiple and irregular pairs, each pair of the latter forming an independent closed circuit, resting part between the coils of one and part between those of another of the short-circuit coils closed in series, the coils being arranged in such numbers and relations, one set to another, as to produce unsymmetrical polarities upon the armature.

555,862 Electric Railway Brake John C Henry, Westfield, N. J Application filed July 3, 1895

The combination, with a car of a magnetic clutch, a dynamo-electric generator on the car, and in power connection with one of the car axles, and in electrical connection with the clutch, a circuit closer on the car controlling the circuit of the dynamo-electric machine, an electric actuating device for the circuit closer, and means on the locomotive for regulating the electric device.

555,891 Electric Arc Lamp Thomas E Adams, Cleveland, Ohio Application filed October 10, 1895.

The invention is designed to overcome the chattering occasioned in alternating current arc lamps when they are started, and consists in the combination of a magnet and carbons with a pivoted lever connected with the armature of the magnet and with the carbons, and a dash pot connected with the lever, the dash-pot being so constructed as to first permit a free movement of the lever then retard the lever, and then permit its free movement whereby the separation of the carbons is retarded and then permitted to separate sufficiently to form a normal arc

555,895 Method of and Apparatus for Preparing or Treating Electrical Conductors. Charles E Carpenter, Bridgeport, Conn Application filed November 16, 1892

The method of preparing electric conductors, which consists in first shaping the conductor then placing the same upon a supporting body, then heating the conductor until it becomes limp or inelastic and then allowing the conductor to cool

555:890. Armature for Induction Motors A L Cushman, Concord, N H Application filed June 24, 1895

An armature for alternating current induction motors having a slotted core, coils forming a short circuit rectangle resting in the slots, the slots being too few in number to cause a set of coils to form a regular figure or rectangle

# Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, MARCH 21, 1896. No. 12


## More Power at Niagara Falls.

By Orrin E. Dunlap.

The work of erecting the third 5,000 horse power generator in the central power station of the Niagara Falls Power company at Niagara Falls is now under way, and is in charge of the force of the Westinghouse Electric & Manufacturing company of Pittsburg, Pa., maker of the dynamos. When this third generator is installed the total power product of this great power plant will be 15,000 horse power, which, as the WESTERN ELECTRICIAN has stated, is to be increased by the addition of seven more dynamos. As yet it has not been decided just how

FIG. 1. MORE POWER AT NIAGARA FALLS.

these additional generators are to be erected, it being announced that the Niagara Falls Power company has under consideration some suggestions of changes, which may eventually lead to placing the additional dynamos down in the big wheel-pit, instead of in the power house, as at present. This method of erection would save the expense of the 138 foot shafts which now connect the turbines with the generators.

This power house of the Niagara Falls Power company is the largest in the world, and the illustrations presented on this and the following pages give the reader a good idea of its magnitude and manner of placing the great power producers. In the foreground of Fig. 1 is seen the upper works of dynamo No. 1. This machine was standing still when the exposure for the picture was made, and the rivets of its side are plainly visible. Just beyond it, however, dynamo No. 2 is seen in operation, making about 250 revolutions a minute, or something like 85 revolutions during the exposure for the picture. The steady manner in which it runs is well displayed by the excellence of the picture, and the reader will find it hard to comprehend that this machine at the time the picture was made was delivering such a mighty force as 5,000 horse power. Immediately to the left of dynamo No. 2 is seen the switchboard structure and the operator in charge. Placed on the switchboard platform are seen the instrument stands, one for each generator and two for the rotary transformers, while in front of each instrument stand is placed a cast-iron stand about 30 inches high, which carries the levers controlling the air for the switch cylinders. It also has other levers and wheels. To the right of dynamo No. 2 is seen the opening in the floor by which access is gained to the interior of the generator.

Beyond generator No. 2 is seen the foundation for dynamo No. 3. It represents the condition in which it was left at the conclusion of the labors of the I. P. Morris company of Philadelphia, Pa., which had the contract for the installation of the 5,000 horse power turbines and connections. It is here the Westinghouse Electric & Manufacturing company is now erecting the third dynamo, and it will not be many weeks before it will have built this latest monument to the great skill of its engineers. All the parts of the generator are on the ground, and the erection is proceeding under the direction of W. F. Lamme and W. K. Dunlap.

Fig. 2 gives a better idea of the size of the Niagara dynamos, with one of them standing still and the other running. It also affords a fine view of the end of the switchboard structure and the subway beneath, in which pass the cables carrying power to the several factories that are supplied from this plant. It also gives a view of the entrance to the stairway leading to the elevator by which the descent is made into the wheel-pit.

In this connection it may be added that the Niagara Electric Chemical company has just let the contract for the erection of a large plant to Rogers & Co. of Tonawanda. It is to be built on the lands of the Niagara Falls Power company.

## Memorial to Franklin at Passy.

According to a special cable dispatch from Paris to the *New York Herald* on March 8th, several hundred persons attended the unveiling of a memorial tablet that had been erected on the site of the villa at Passy occupied by Benjamin Franklin from 1777 to 1785. It was at this villa that Franklin conducted many of his early experiments. The dramatist, M. Manuel, president of the Passy Historical society, presented the tablet. M. Faye, a member of the French Academy, spoke of Franklin's scientific researches. Mr. Eustis, the American ambassador, acknowledged the gift of the tablet. M. Roujon, director of the Society of Fine Arts, Moncure Conway, Henry Bacon the artist, Meredith Read and many ladies were present at the ceremony.

## Apparatus for Demonstrating the Heating Effect of Electrical Oscillations in Wires.

The theoretical study of electric oscillations, says J. Klemencic in *Wiedemann's Annalen*, shows us that the distribution of such a current in a section of the conductor differs from that of a continuous current. In the case of oscillations the density of the current is maximum near the surface of the conductor wire and minimum at the center; in fact, with oscillations of rapid frequency the current is confined to a very thin layer of metal at the surface, and the thickness of this layer depends on the nature of the conductor. In consequence of this fact the resistances of wires are different for oscillating and continuous currents. The development of heat being dependent on the resistance, the proportion existing between the two is as their resistances.

The experimental investigations of Bjerknes and those of Klemencic relative to the absorption of energy in different wires conveying oscillating current have given at least a qualitative endorsement to the theory. The latter, desiring to study the question from a quantitative standpoint, designed an apparatus for the purpose.

This apparatus is represented by Fig. 1. It consists principally of two air thermometers $T_1$, $T_2$, in which are sealed the wires upon which one desires to experiment, a condenser $C$ and an exciter $F$. It is known that Riess has already studied with the aid of a similar apparatus the development of heat by discharges from a Leyden jar.

Fig. 2 gives in detail the form of air thermometer used, $a$ $b$ and $c$ $d$ are copper wires of three millimeters diameter, to which are soldered between $b$ and $c$ the experimental wire, of about 0.4 millimeter diameter. These copper wires are fixed in the glass tubes by means of sealing wax at $c$ and $d$. In the body of the air thermometer is sealed a stopcock $H$ and an alcohol manometer $M$. The two thermometers contain wires of equal length, but of dissimilar metals. They are fixed by the aid of copper wires at the terminals $K_1$, $K_2$ and $K_3$, arranged to facilitate an exchange of thermometers. Terminal $K_1$ is connected by a copper wire of three millimeters diameter to an armature of the condenser $C$, of which the other arm connects by a similar contact with the exciter and the terminal $K_3$. The condenser is formed of tubes filled with mercury, the interior tube having 18 millimeters diameter. The most favorable length of spark is three millimeters. An induction coil $J$ is connected to the armature of the condenser. The apparatus produces oscillations of less than $10^{-6}$ of a second duration.

The method of operation is very simple. First a battery current from accumulators is sent through the two wires, and change in the level of the mercury at $M$ noted. The individual resistances of the two wires are thus compared. Equilibrium having been restored by withdrawing the current and opening the stopcocks, the oscillating current is sent through the conductor. Again the level at $M$ is noted and comparison shows the relative resistance as follows:

1. German silver and brass, six centimeters long and 37 millimeters diameter; ohmic resistances, brass 0.042, German silver 0.145. The mercury column was forced up the open leg of the thermometer with a continuous current of one ampere, 13 millimeters with the brass wire and 48 with the German silver connected. With the oscillating current the elevations of the column were 12 and 26 millimeters respectively. The comparisons show a ratio of 3.7 for continuous and 2.2 for oscillating current.

2. Iron and platinum wires of three centimeters length and four millimeters diameter, ohmic resistances, platinum 0.068, iron 0.037. With continuous current the mercury rose with the iron 13 millimeters, with platinum 23 millimeters. With the oscillatory current iron 35 millimeters, platinum 15 millimeters. The ratio in the case of continuous current of the mercury level is 1.8 when compared with the ohmic resistances, but in the oscillatory experiment the magnetic properties of the iron increased the resistance so as to make this superior to that of the platinum.

To enable an audience to participate in the experiment it would be necessary to project the thermometer on a screen, and it would also be of advantage to use a more powerful source of energy. The thermometer should be covered with paper to prevent a possible error from expansion of the mercury by heat from the surroundings.

## Secondary or Indirect Electrolysis.

When the central compartment $D$ of a vessel $A$, divided into three portions by the porous walls $B$ $B'$, Fig. 1, is filled with any solution, while the two extremes contain an anode $E$ and a cathode $F$, in similar or different electrolytes, the decomposition of these, $C$ $C'$, is not noticeable in the compartment $D$; the solution, irrespective of its composition, remains intact through the process going on either side of it. But now, if in this middle portion a plate or series of metallic plates be placed, as shown at $G$ $G$ $G$, an electrolytic action at once takes place, which E. Andréoli in *Le Genie Civil* denominates secondary or indirect electrolysis.

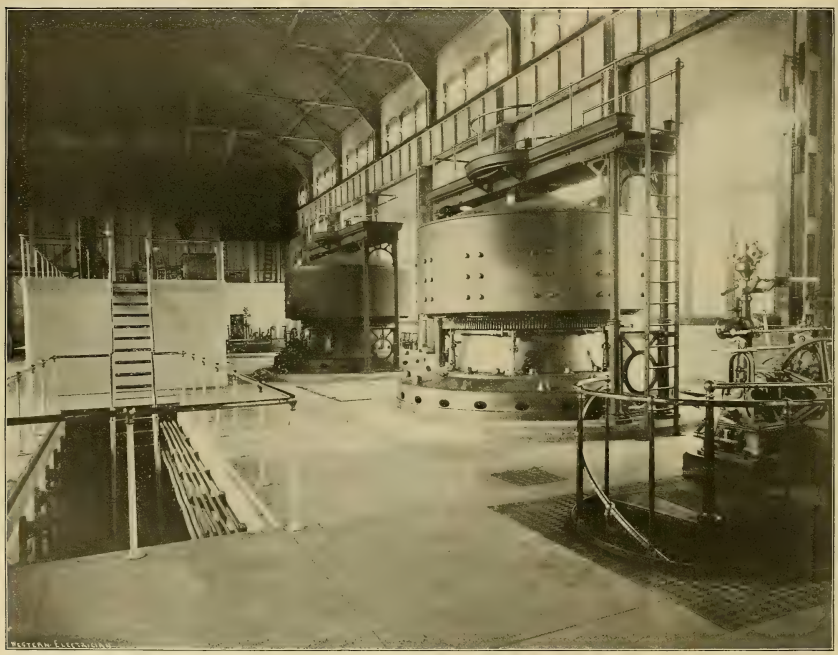


FIG. 2. MORE POWER AT NIAGARA FALLS.

Suppose that the two compartments $C$ and $C'$ contain salt water, and the center holds a solution of cyanide of gold. For the positive pole at $C'$ it is proposed to use an anode of carbon, and for the cathode $F$ iron.

As soon as the current is established in $A$, the electrolysis manifests itself by the disengagement of chlorine at $E$ and the deposition of caustic soda at $F$ while the gold cyanide is not in the least modified by this transmission of the ions.

But now plunge into the central compartment one or more metal plates at $G$, $G$, $G$, $G$, $G$, $G$, there will be a deposit of gold upon these plates, although they are not connected to either the one or the other of the poles of the generator, nor to the anode or cathode of the other compartments. Time only is required for this action to completely remove the soda and chlorine from the cell containing the sodium chloride, and to deposit all the gold contained in the middle solution.

The film of liquid opposite the diaphragm of the negative compartment becomes positive, the proof of which may be seen when a plate of lead is used opposite the

diaphragm. It becomes completely peroxidized while the other surface is covered with a deposit of gold. This is true of all similarly placed plates. Whether they are arranged horizontally or perpendicularly, the same relative side is thus coated.

There are reactions of an interesting character, but the only fact to which attention is called is the deposit of a metal by the electro-immersion of metallic leaves in the solution.

The saline solution can be exchanged in C and C' by a solution of gold cyanide in every respect similar to that previously contained in the middle. The anode is made of lead, the cathode of iron. After a few days, if one

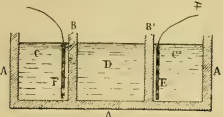



FIG. 1. SECONDARY OR INDIRECT ELECTROLYSIS.—SIMPLE FORM OF BATH.

takes 100 cubic centimeters of the solution in the outer cells, evaporates and assays the residue, there will be found in this mass exactly the same amount of metal which the solution originally contained. On the negative plate there will not be found a trace of gold, yet while this process has not in the least affected the gold solution, it has exchanged position with the saline solution.

Another utilization of this indirect electrolysis is the tranformation of the bisulphite of sodium into the hydrosulphite. It is known that the ordinary electrolytic decomposition of the compounds of sulphur is impracticable. Indirect electrolysis, on the contrary, readily and rapidly changes the bisulphite into the hydrosulphite without the necessity of concentration to 35° or 40° Baume.

Here again the nature of the liquids to be decomposed in the lateral compartments matters but little. It would be well, though, to choose those which are the best conductors and do not require special electrodes. The decomposition of the sodium salt alone is of interest. From a specially arranged reservoir a portion of the solution is drawn into *D*, and, as in the case of the gold solution, no change takes place until metallic plates are plunged into the solution; then, when two plates are immersed, one on the positive and one on the negative side of the cell, an evolution of gas takes place; the liquid immediately acquires bleaching characteristics it did not before possess; and if there is abstracted a portion of the solution and it is placed in a vessel containing wool it will be seen to bleach it rapidly.

The old writers have held that in an electrolyte the action takes place between the two poles in a manner which may be represented as a chain of interrupted molecules, and that each metallic plate interposed between the anode and the cathode becomes positive on the side next the negative pole, and vice versa. But it is evident that in proportion as the distance between the plate and the pole is increased the resistance increases, until a point may be reached where the efficiency would be nil.

Again, in the transmission of current between two

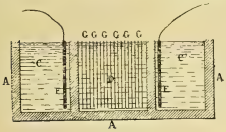



FIG. 2. SECONDARY OR INDIRECT ELECTROLYSIS.—MODIFIED FORM OF BATH.

poles separated by two plates there is but a single liquid. Care must be taken not to confuse an old experiment demonstrating direct electrolytic action with the indirect form, which latter shows these curious phenomena, and denies the theory of the transfer of ions from the extreme of one compartment to the other, and reciprocally, across an inert electrolyte; that is, without rendering it alkaline or acid. It is simply necessary to obtain this result to render the electrolyte active, to place metallic plates, either solid or perforated, or as a grating, cutting off a large area of the bath, that this latter may be influenced by a change of polarity, acting, so to speak, as a liquid negative electrode of the positive compartment, to reduce the gold, the silver, etc., and deposit it upon the plates, which have no direct contact with the anode, the cathode or the generator.

## Röntgen Rays at the University of Minnesota.

By Fred. S. Jones.

Experiments on the Röntgen rays conducted at the physical laboratory of the University of Minnesota during the last month have been productive of very satisfactory and interesting results, some of which seem worthy of mention.

Although Professor Röntgen and many other investigators have failed in their attempts to analyze the X-rays by the ordinary methods of dispersion and diffraction, certain observed phenomena lead to the conclusion that there is an analogy, at least between ordinary light and this new kind of radiation. The latter seems to be made up of many different rays which differ widely in penetrating power, just as white light is the sum of rays of various wave lengths and different properties.

All investigators have obtained their best results with tubes excited by high potentials, and the time of exposure necessary to obtain satisfactory sciagraphs has invariably decreased with a rise in the applied voltage. But lower potentials will undoubtedly produce radiation capable of penetrating cardboard, paper and wood,

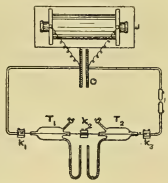



FIG. 1. APPARATUS FOR DEMONSTRATING THE HEATING EFFECT OF ELECTRICAL OSCILLATIONS IN WIRES.

capable of acting energetically on ordinary photographic plates, but failing to pass through substances which are readily traversed by rays excited by higher potentials.

As an illustration of this, the writer exposed a hand to the rays from a Crookes tube excited by a potential which produced a spark of about half an inch. The time of exposure was 2½ hours. On developing the plate, a perfect outline of the hand appeared, the negative being

tal radiation but quite transparent to rays excited by higher voltage.

These and other experiments justify the theory that the Röntgen rays vary greatly in penetrating power and that potential applied to the vacuum tube plays much the same role in exciting these different rays as temperature does in producing light rays, new wave lengths being excited as the temperature rises.

Investigations are now being carried on with a view to

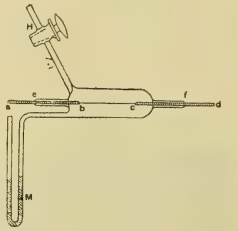



FIG. 2 APPARATUS FOR DEMONSTRATING THE HEATING EFFECT OF ELECTRICAL OSCILLATIONS IN WIRES.

determining the various potentials necessary to excite the several rays showing this selective penetration.

Another series of experiments seem to indicate that each ray requires a definite and comparatively short time to produce its maximum effect on a sensitive plate. A narrow saw-blade was laid over a properly protected plate and exposed five minutes. A thick sheet of copper was then slipped over one-fifth of the plate and the exposure continued 10 minutes; the copper was again slipped forward and the exposure continued 15 minutes. In this manner the plate was divided in to strips, the times of exposure varying from five minutes to one hour. The negative showed a very slight difference between the five minute exposure and the quarter hour exposure, but none at all for the strips exposed longer than 15 minutes. These particular rays produced their maximum effect in from five to 15 minutes; longer exposure was therefore useless. Is it not possible, then, that a differ-

RÖNTGEN RAYS AT THE UNIVERSITY OF MINNESOTA

1. Watch and chain.
2. College badges in mahogany box.
3. Copper coin.
4. Weights in heavy velvet lined mahogany box; blank space contains aluminum.
5. Coins in inner pocket of heavy seal purse.
6 and 7. Colored glass.
8. Key.
9. Lead pencil.

entiation and classification of these mysterious forms of energy may be accomplished by referring them to the various potentials which excite them, by noting their penetration of various substances and the time of maximum effect on uniform photographic films?

The effects of variation in the tube itself have not been investigated since but one tube was at the disposal of the department.

a "deep" one, but not the slightest indication of the bones of the hand could be found. Raising the potential to that necessary to throw a six-inch spark from the coil, an excellent sciagraph of the entire bony structure of the hand was obtained with an exposure of less than 30 minutes. The connective tissue was evidently entirely opaque to rays produced by low voltage.

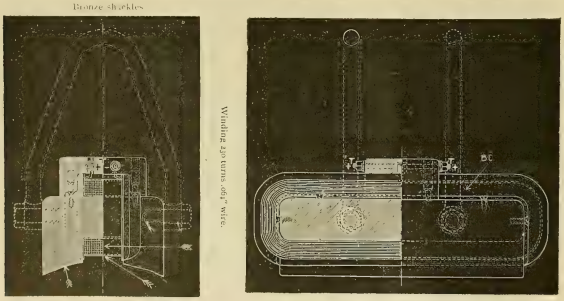
A bit of sheet aluminum is fairly opaque to low poten-

## Electric Cranes and Electro-magnets for Lifting Purposes.

Considerable attention is being given this subject in England at the present time, and experiments are being conducted under direction of the army and navy officers for utilizing the devices already constructed and now in course of development. The magnets are used chiefly for lifting shot at the Royal Arsenal at Woolwich, Fig. 1. They were designed by Major H. C. L. Holden for the special purpose of lifting shot used for proving guns and general ballistic experiments. The shot are of special form, having flat instead of pointed heads, in order that their motion may be arrested as quickly as possible in the sand of the butt into which they are fired. The shot range in weight from 1,800 pounds, that of the projectile fired from the 110-ton gun, down-

FIG. 1. ELECTRIC CRANES AND ELECTRO-MAGNETS FOR LIFTING PURPOSES.

ward to the smallest bores. They are piled one upon another in the stores, and formerly it proved laborious work moving them when required, not only on account of their weight, but also on account of the difficulty of getting slings round them. The introduction of the electro-magnet in the place of the slings has made the task easy, and one which is, moreover, quickly performed. The illustrations, Figs. 2, 3 and 4, show clearly the construction and method of employment. The body or core of the magnet is ∩-shaped and in one forging. The winding is mechanically protected by stout brass flanges and is covered with thick brass strip. The ends of the winding are led to duplicate terminals. Duplicate twin wires, to prevent accidents in the case of the wire fouling and breaking, being taken over pulleys to the switch-box on the counter-weight at the back of the crane. A single-pole switch is placed in this box and is used, in shipping department of the same institution. Pieces of iron and steel weighing two tons are readily handled by this apparatus at these works. The electric jib crane, shown in the illustration, was constructed and is used in the Sandycroft works under patents of Dr. N. S. Keith. When the photograph was taken from which the cut was made the apparatus was lifting a one-ton billet of steel from a railway wagon. These billets are used for forging into shoes and dies for gold ore stamp mills. The magnet takes 5½ amperes at 110 volts, and will support a weight of two tons of iron or steel. By employing this crane or magnet it is claimed that three men do the work in one-quarter of an hour which previously took six men one hour and a half to perform. Fig. 6 shows another magnet used in the shipping department of the works. The piece which it is holding up weighs 1,800 pounds, and is a cast-iron "jaw" for a rock-breaker. By the use of the magnet, the handling of iron pieces weighing over one hundred-weight, in packing and shipping, is done in less than one-half of the time previously required. The switch at the top is employed for throwing on and off the electric current. The pole-ends are made of a peculiar shape and longer than necessary for simple lifting purposes, being especially shaped for packing certain iron pieces in boxes. The hook between the limbs is for attaching slings for lifting non-magnetic substances. This magnet weighs 250 pounds and takes two amperes at 110 volts to energize it. The cuts are reproduced from the London *Electrical Review*, which says that "it must be admitted that the use of an electro-magnet for the foregoing purposes must be exceedingly convenient, and in closely packing iron or steel bars in railway trucks it must be admirably suited. But how far electro-magnetic devices can be used for safely moving masses of iron and steel over shop floors remains to be seen. Providing there is no break in the electric circuit, there would be little to apprehend; and, if one can insure absolute immunity from such a contingency, there is little, to our mind, to prevent a wider use of magnets for lifting purposes."




FIGS. 3 AND 4. ELECTRIC CRANES AND ELECTRO-MAGNETS FOR LIFTING PURPOSES.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Western Electric Telephone company, which has a line as far north in Minnesota as Waseca, and proposes to reach St. Paul and Minneapolis, may be headed off by the threat of the Northwestern Telephone Exchange to parallel its line to Albert Lea, Minn., if it extends to the Twin Cities. The former had hoped to connect with the Northwestern at terminal points, but the Northwestern is not favoring its independent competitors in that way if it can help it, and the Western Electric fears there is no way to compel such connection. The Western Electric may hold off until a meeting of the Legislature, when it is hoped a law will be passed compelling connections at terminal points.

The Hardin County Telephone company has been incorporated at Eldora, Ia., and expects to cover the county and connect with other systems as rapidly as possible. The Iowa Union will build across the northern part of the county with its line from Dubuque to Sioux City, and a telephone war of no small dimensions is anticipated in that county. If the Postal Telegraph extends from Webster City to Iowa Falls, as is expected, it is rumored a new company will come with it

## Quick Methods of Testing for Faults in Electric Wiring.

By A. E. Hutchins.

We will start with a complete system of wiring, say for a large office building, hotel or factory, where a complete equipment of multiple (two-wire) system of electric wiring has been installed, with generating plant included, and cut-outs and fuses and switches placed and connected; also instruments (for governing and regulating dynamos and plant) placed on switchboard. The house wiring will consist of a number of feeders or risers running from the bus-bars on the switchboard of the generating plant or dynamo room, and thence to different sections and stories of the building or buildings, where they severally end at distributing or cut-out boxes, where a number of branch or lighting and motor or electric heating circuits converge or get their supply. The feeder or riser circuits are also connected at or near the feeder ends with a set of wires we will call helper or equalizer wires, that are run from one feeder to another and another, and so on, for the purpose of providing a means whereby one feeder, if over-burdened with current, may be, through these equalizer wires, assisted

FIG. 2 ELECTRIC CRANES AND ELECTRO-MAGNETS FOR LIFTING PURPOSES.

from another feeder or feeders, and so borrow or lend. Not to have too many complications, we will employ one set of tell-tale wires running from the principal feeder and back to the switchboard. The electric fixtures and drop lights have been put up and connected and lamps are in. Fan and other motors ready to run an electric heating apparatus are connected. The buildings are also equipped with gas, steam and water conductors.

A man is sent to start the electric generators and give the plant a trial run. We will say that he has undertaken to run it and finds that nothing will work. We will say he then calls upon the reader and myself to first dissect the wiring and see where the trouble or difficulties lie. To start in, we will first disconnect the different feeders at the switchboard of the main bus-bars, and then we will connect the terminals of a magneto (first used to test with) to one set of feeder wires, remembering that if the two leads of the feeder are cross-connected by a conducting channel anywhere else than the winding of the magneto, then by turning the magneto (or generator) the magneto bell will ring. We will now see that all the incandescent lamps in the entire building are disconnected, as their filaments afford a path from one side of the feeder to the other. We will next open the various motor or heating circuits, and if we still get a ring by the magneto we may ask, Isn't there still another normal channel for the current to pass in a circuit as we are looking for normal causes before looking for abnormal. What about those two tell-tale wire

leading back to the indicator or voltmeter in the dynamo room? As a voltmeter, it is connected across the polarities of the circuit; and so we next disconnect those wires at the instrument, and if we still get a ring, and no other normal channels or paths for the circuit are to be found, we look for crosses or trouble elsewhere

Recollecting that this one feeder, to which the magneto is still connected, is connected with all the other feeders by means of the equalizer or helper wires, we will first disconnect the different feeders at the feeder ends, to cut out or disconnect all communication with their branch circuits, and then, by trying the magneto and getting no ring, should we conclude that the coast is clear so far as feeders and equalizer wires are concerned? No; not until we go back to the main bus-bars, and after disconnecting dynamos and instruments from the bus-bars, then connect or switch in the feeders, one by one, and if you get a ring from the magneto on connecting any of them back to the bus-bars again, you will then discover that though separately each feeder wire is properly connected to the like polarity of bus-bar, yet a mistake has been made by one or each lead of the equalizing wire connecting the opposite instead of the same polarity of feeder wire, and thus making what is called a cross. Now connect branch wires at their feeder ends, and if all test out clear or free from any cross, we then test the entire wiring system to the lamps at once for a ground by connecting but one terminal of the magneto to both polarity wires of the feeder and the other terminal to a water or gas pipe as a common ground. If any contact or ground occurs at any point or ramification of the system, the bell will ring and tell the tale for the entire system at once—that there is a ground or "bug" somewhere. Then, by testing at feeder ends separately (isolating that feeder from the others) you proceed to separate the various circuits and test separately till identifying the grounded or, as the case may be, the crossed circuit through different (or double) grounds. Of course, if a wire is grounded on a fixture (chandelier), being insulated from the main pipe by an insulating joint, then that ground has to be located separately.

Now when we have cleared all the grounds and crosses, if any, we may look to see if each individual light or outlet has proper and through electric service from the cut-out box at the feeder end. Proceeding to connect the magneto to feeder end and branch wires, we touch the wires at the outlets, or close the circuit in the lamp socket of the fixtures by inserting a metallic tool, and, by getting a ring from the magneto, we demonstrate a true circuit. If the magneto is beyond hearing distance, then allow the current from the magneto from the outlets or ends of the wires to pass through your thumb and finger, or put your finger end up in the lamp socket instead of the tool, and you will feel when the current is there. If a wire is broken so you do not get current, then by grounding separately each wire at one end and by grounding the other end through the magneto, if it rings from but one wire and if you have connected to the proper wire at the cut-out box—then one of the wires is identified as broken, or is run to another or wrong outlet, but it may in like manner be so identified. If no gas or metallic piping is accessible to ground on, then the circuit may be completed through an extra wire provided as a temporary leg from the magneto to outlet.

In a case where a confusion of wires is found—as at a place for general distribution and thence concealed from view till appearing at the other ends or outlets—the quickest way to pair them off into circuits is to connect the terminals of the magneto to the outlet for light or motor (or with a flexible wire or cord to attaching plug) and to the screwed-in lamp socket in a fixture. Test with your fingers the ends of the wires in the cut-out box, and when you feel the current you know you have got the proper wires running to that outlet, so they may now be rightly connected to the proper cut-out if desired. If you have a live current (low-tension) to test with at cut-out box, a very convenient method of identifying the wires and pairing them into circuits is to close the ends of the wires at one outlet at a time, as before, and then go to the cut-out box, connect with live current from fused cut-out one wire of lighting circuit, and then, with one hand on the other polarity of the live current wire (perhaps from off a main binding post of the unfused cut-out), take the other hand and feel the ends of the wire to be tested or identified (*i. e.*, close the circuit through your person). If you feel a current through your body you will know you have identified the circuit, or else another contact or cross is discovered instead, and you cannot thereby blow a fuse or a plug, as the resistance of your body protects the fuses and does not harm the person.

A very quick method of identifying grounded wires is also by feeling or closing the current through the hand as a testing instrument If testing this way by use of alternating (secondary) live current, great care should be taken lest the transformer be defective and make yourself liable to get a dangerous shock from off the primary or high-tension wires, as you may get a shock (from a little dampness in the transformer), due to the primary wires being grounded outside. It must also be remembered that as some meters have a high resistance

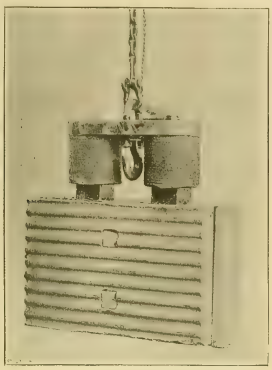


FIG 6 ELECTRIC CRANES AND ELECTRO-MAGNETS FOR LIFTING PURPOSES.

winding that contacts or closes the two polarity wires on which it is placed, it must not be mistaken for a cross on the lines in testing.

When cut-outs or fuse blocks are in place, but plugs or fuses are not in, before fusing them up, if live current is present in the cut-outs, close or bridge one plug or fuse opening, with a metallic tool, pliers or screwdriver, and by closing the other plug socket or contact screws, by sticking your finger into the plug socket or by spanning the open place for a fuse wire with thumb and finger, you can quickly find if there is a cross on any of the circuits and yet not burn out a fuse. In testing out a three-wire system, on dead wires, those intended for positive and negative wires may be bunched together to be attached to one terminal of magneto or a testing battery, and the neutral bunch of wires to the other. The reader is aware of the use of various galvanometers and the Wheatstone bridge for greater precision in locating faults. A voltmeter is also a very serviceable instrument in testing by use of live current, its greater or lesser deflections showing in a practical way the stronger or weaker grounds or crosses that occur through dampness, wet conduit tubes, etc.

Mistakes sometimes occur by wiremen when they cut in two double-pole switches on a three-wire branch circuit from two (one way) branch cut-outs, as the two adjacent terminals in two neighboring cut-outs are of opposite polarity and by mistake they use them, or try to, as a neutral wire, and hence a cross occurs. Sometimes the wires from different cut-outs supply one fixture, and by mistake are connected so at the switches that one polarity from each cut-out passes through one double pole-switch and the other polarity through the other switch, so that one switch turns on no lights, but the second one turns on all, or vice versa.

## Street Railway Conductors Afflicted with Metallic Poisoning.

Street railway conductors in different parts of the country have complained about their eyes being affected. In many cases they were badly swollen, and in some partial blindness followed. One who was obliged to undergo medical treatment reported that he had observed from time to time that his hands grew black from contact with the brass railing of the car when he jumped on and off. In windy weather he had to wipe his eyes more or less to brush away the moisture. These two things he only observed after he was well along in the stage of the eye trouble, having been afflicted for four weeks. He was treated for metallic poisoning, finally recovering without difficulty. Then he came to the conclusion that the contact with the railing was responsible for the trouble. Since that time he has worn gloves and has had no further trouble.

## Prof. Röntgen Made a Baron.

It is reported from Berlin that, in recognition of valuable services to his native country and to all the world, Prince Ludwig of Bavaria has created Professor Röntgen of Würzburg a baron. Of the private life of the discoverer of the X-ray it is said that little is known, as the professor lives a secluded life, being present only at important social gatherings of his students. He might be called a bookworm, and his townsmen and most intimate friends are most surprised at his sudden elevation and the distinctions shown him by royalty and scholars

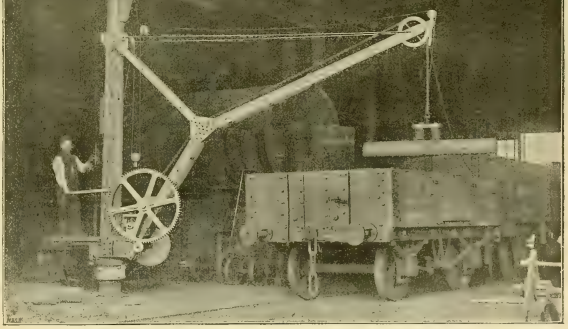


FIG. 5. ELECTRIC CRANES AND ELECTRO-MAGNETS FOR LIFTING PURPOSES.

## What the "Western Electrician" Can Do When Crowded.

From the *Pacific Electrician.*)

The WESTERN ELECTRICIAN had a chance recently to show what it can do when it is crowded. A fire in the printer's office destroyed almost all the forms just as it was going to press, and yet the issue came out only one day late!

Western Electrician.

EVERY SATURDAY.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome, and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

## HIGH WATER MARK
## CIRCULATION, 16,630.

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THE publication offices of the WESTERN ELECTRICIAN have been removed to much more commodious quarters. Our new address is Suite 510 Marquette building, Dearborn and Adams streets, Chicago.

The telephone number remains unchanged—Main 1746.

THERE is unmistakable evidence of internal disorder in the appearance of the last issue of an eastern contemporary which is now engaged in an earnest effort to establish a reputation for sanity. Our contemporary makes a practice of publishing each week a review of current electrical literature, but in this particular, as in other ways, it record is principally one of failure. The most notable feature of the department last week was the utter absence of any reference to American publications. We do not believe that any of our contemporaries will feel aggrieved at the omission, but the lack of judgment displayed may be taken as another indication of mental deterioration which sometimes accompanies old age.

WITHOUT any explanation whatever, the names of the gentlemen who have heretofore been so conspicuously advertised as editors of the *Electrical Journal* were omitted from their accustomed places upon the front cover page in the issue of March 15th. The omission of this important feature is particularly significant at this time. It can only be construed as a repudiation of the policy and methods which have characterized this enterprise from its inception, culminating in the publication of a most disgraceful and disgusting cartoon in the previous issue. It would appear that Dr. Carhart and his associates had at last recognized the equivocal position in which they were placed by their connection with the Barrett-Hornsby enterprise and had determined to withdraw every semblance of their approval and recommendation of the scheme. No other inference can be drawn, and we are fully convinced that none other was intended. It is a fitting rebuke and is certainly justified. We have received positive assurance that these gentlemen have never had personal supervision of the paper, but, as we surmised, their names were used by the management for the influence which their reputations commanded. With their retirement is removed the last vestige of respectability. Henceforth we may expect the publication to be conducted as a typical Barrett-Hornsby enterprise, with all that this implies.

IT is with considerable gratification that we learn from authoritative sources that the outlook for the convention of the National Electric Light association at New York in May is full of promise, and that the exhibition to be conducted in connection with this convention has already reached the point where its success is assured. We believe that this gathering will have a stimulating influence upon the trade; that a first-class exhibition, such as is promised by the management, is just what is needed at this time to attract general attention to the electrical business and revive popular interest in electrical matters. The convention will draw central station men from every part of the country to New York, and this will be sufficient inducement to cause manufacturers and dealers to make creditable exhibits. These displays will not, however, constitute the entire exhibition. Arrangements have been made to secure special attractions that will appeal to the general public as forcibly as to the electrical fraternity. Everyone interested in the general advancement of the arts and sciences will find much to study in the historical department, while those who are looking for spectacular effects and sensational features will not be disappointed. We earnestly hope that the convention will be interesting, instructive and eminently successful, and that the exhibition will receive the patronage and encouragement which it deserves. Western members are particularly interested at this time, as they desire to make the administration of President Wilmerding the most successful in the history of the organization.

ALDERMAN GREENACRE'S proposal to bury all the trolley wires in Chicago would be alarming if it were likely to reach concrete and effective expression. But, as silly and ill-informed as the Council is on matters of electric railway transportation, this is not likely to be the case. The alderman introduced an order in last week's meeting of the illustrious body of which he is a member directing the corporation counsel to prepare such an ordinance. This order was referred to the judiciary committee, of which Alderman Mann is chairman, and seems destined to die a natural death in committee. Mr. Mann, who was lately nominated as a candidate for representative in Congress, is a sane man, and he has his own opinion of the proposition. "Some of the papers startled their readers by declaring the order for an ordinance was passed," he said, "and many persons in my end of the city expected to see trolley wires being torn down on their way down-town yesterday. However, the order was not passed, but was referred to the judiciary committee. That is as far as it will get. It will be placed on file without a doubt. I do not believe the ordinance is at all practical, and further than that, the people are with the trolley. They are pleased with the change from the old horse car system. I don't believe the council can enforce such an ordinance, even should it be passed."

Alderman Mann takes the sensible view of the extravagant proposal and voices the prevailing opinion of the community. Alderman Greenacre contends, however, that the General Electric Railway company proposes to use an underground trolley system; and if this is so, he argues, why cannot the other companies do the same? We suggest that the alderman can best display his sincerity by waiting until such a trolley conduit road is built and operated through varying seasons. If, contrary to the recent experience of the North Side company with the same system, the line be proved a success, Mr. Greenacre will have a more tangible basis for his proposed reform. All he needs is patience.

IT is not to be assumed that there is unanimity of opinion among electrical engineers upon the outlook for acetylene. There are among them many men who think the new illuminant will become a potent factor in the commercial world, and as many more who look upon the project as visionary. That the former are confident is shown by the fact that they do not hesitate to assert their views and give their opinions the weight of their professional reputation. They point out, too, the difficulties with which the electric light was forced to contend in the early days, and they say that the obstacles in the path of the acetylene project are insignificant by comparison. Assuming that the figures given by those not favorable to the new gas are correct, they say that improvements and refinements will reduce the present cost sufficiently in a short time to make the new illuminant commercially successful. They direct attention to the fact that there are many special applications for which acetylene is peculiarly fitted, one of which is dispelling a fog at sea. The superiority of the acetylene flame for this purpose will, it is claimed, open up at once an important field in which it will be without a rival. There are other applications, too, equally important, where it is alleged this form of illumination is incomparably superior to all others. But it is admitted by all, friends and opponents alike, that the present policy of dispensing state rights, as followed by the company in control of the so-called Willson process, is detrimental to the interests of the new illuminant.

TO MANY investigators who have been experimenting with X-rays the most important feature of Tesla's communication in the *Electrical Review* last week was his reference to the influence of these rays upon a living subject. He said:

> By exposing the head to a powerful radiation strange effects have been noted. For instance, I find that there is a tendency to sleep and the time seems to pass away quickly. There is a general soothing effect, and I have felt a sensation of warmth in the upper part of the head. An assistant independently confirmed the tendency to sleep and a quick lapse of time.

This is a point that has been noted by other experimenters and it has led to much speculation as to the possible effect of these rays upon the physical organism, although the subject has not received the consideration which it seems to be entitled to. But now that Tesla has called attention to it there is a probability that it will be given more attention, especially as he suggests that "it may be possible by these ray-like appliances to project a suitable chemical into any part of the body." He is not confident by any means of the correctness of his views, though, as he says, "Should these remarkable effects be verified by men with keener sense of observation, I shall still more firmly believe in the existence of material streams penetrating the skull."

The announcement of these conclusions by Tesla has already excited comment. Professor Stine does not agree with his eastern contemporary, and in an interview takes the ground that thus far not a single experiment has been made to show that the X-ray has any physiological effect. He says that it has been tried on microbes without apparent result, and claims that the peculiar vibratory motion and the heat Tesla speaks about are much more noticeable when the tube does not give off the X-ray than when it is in perfect working order. His conclusion is that "the pulsations one feels when making a sciagraph of the hand, for instance, are no doubt the effect of heat and the external change of electricity on the air." Concerning the suggestion that the X-ray may be utilized to project chemicals into the human system, Professor Stine says that he can find no authority for such an opinion in the accepted theories of to-day. "I do not believe that we shall ever be able to take medicine that way," is his personal opinion. He has no faith in the emission theory and is evidently very much surprised to find Tesla making such a suggestion. It may be added that Mr. Tesla's ideas as presented in his paper are not in line with what was generally expected from him by his friends.

At the present time all these theories are purely speculative, but they should not be dismissed as visionary. They deserve to be investigated thoroughly and intelligently.

## Proposed Bill Abolishing Niagara Commission.

[From the Niagara Falls correspondent of the WESTERN ELECTRICIAN.]

The climax of the opposition of the commissioners of the New York State Reservation at Niagara to the diversion and use of water of the Niagara river for power purposes came on the night of March 9th, when Senator Ellsworth of the Niagara district introduced a bill in the New York state Legislature to dispense with the further services of this commission in the management of Free Niagara and placing the management of the State Reservation at Niagara in the hands of the State Forest, Fish and Game commission. In other words, the commissioners of the State Reservation are to be legislated out of office because of their interference with the power matters at Niagara.

There is no doubt that this interference is their sin. It has become a matter of more than state talk that the commission is continually interfering with the power question, and so public has this become that both the Niagara Falls Power company and the Niagara Falls Hydraulic Power & Manufacturing company are constantly in receipt of letters from manufacturers seeking sites asking if the commissioners or state is likely to interfere to any serious extent with their power rights or privileges. This situation has, in fact, become quite serious, and it has had and is having a tendency detrimental to Niagara industrial interests.

Andrew H. Green of New York is at the head of the Reservation Commission, and he has made the power question quite a hobby. At all the meetings of the commission, in its communications to the state Legislature, and even in the late constitutional convention, Mr. Green's apparent opposition to the development of Niagara power manifested itself, and now it is sought to end these attacks by legislating Mr. Green and his colleagues out of office.

As the New York legislature is Republican, and as Senator Ellsworth is the republican leader, there seems little doubt but that the bill introduced by him will become a law. Were it not for the fact that one clause of the bill provides that the present superintendent of the reservation and all other persons employed by the commission shall continue in office, it might be suspected that the introduction of the bill had for its purpose the removal of Superintendent Thomas V. Welch, who is a democrat, and who has held this office since the reserve was established on July 15, 1885.

This bill will naturally intensify the legislative discussion of Niagara power matters, and probably considerable of the remaining time of the session will be given over to this subject, for in addition to the bill here referred to there is the bill mentioned in the WESTERN ELECTRICIAN of last week, by which the Niagara Falls Hydraulic Power & Manufacturing company seeks to obtain the right to enlarge its canal until 200,000 horse power shall be available. On the afternoon of March 11th the judiciary committee of the Assembly gave a hearing on this last mentioned bill. At this hearing the reservation commissioners were represented by Superintendent Welch. He offered no objection to a confirmation of the present rights of the company. Letters produced by him from the commissioners showed an apparent difference of opinion on the subject. President Green was unalterably opposed to further concessions, while Commissioners Robert Hamilton of Caledonia and Robert L. Fryer of Buffalo did not object to an enlargement of the canal to a width of 100 feet and a depth of 14 feet. The attorney for the power company pointed out that it was the pioneer in the development of Niagara power and therefore entitled to the same consideration as had been shown other power corporations. He pointed out that the company had invested a large amount of money and that there were 19 manufacturing establishments on its lands, representing invested capital to the amount of $4,739,000, and giving employment to 1,213 persons.

Clemens Herschel, the eminent hydraulic engineer, whose paper on Niagara power was recently reviewed in the WESTERN ELECTRICIAN, stated that with the Niagara Falls Power company taking enough water to develop 200,000 horse power, and the Niagara Falls Hydraulic Power & Manufacturing company taking a like amount, the flow in the river would be decreased less than 10 per cent. He estimated, as a result, a difference of three inches in the thickness of the sheet of water going over the American Falls.

The hearing was adjourned until Wednesday, March 18th, when it is expected that President Andrew H. Green of the Reservation Commission will be in attendance

## Improvements in Accumulators.

Doctor Sieg at a recent meeting of the Electrotechnic society of Cologne according to *Elektrische Zeitschrift* communicated some interesting information relative to some improvements in accumulator batteries.

The improvement pertains mainly to the manufacture of the molds for casting the lead plates which support the active matter. These are lighter, being about four millimeters thick, the negative plates used being those of Aloys (Zettler's patent) which are capable of the best results.

Especial attention has been paid to the question of accumulators for road service, and the model presented by the construction company of Cologne is considered extremely practical.

The space between plates is maintained by celluloid separators, which are corrugated and perforated, thus accomplishing great power of resistance to a lateral crushing strain, while affording most excellent circulation of the electrolyte. This space is reduced to 2½ or three millimeters. The cells are of hard lead, furnished with sealed covers. These batteries are especially applicable for traction and for lighting trains. They have been adopted for the Marienberg line.

Each carriage carries a battery of eight elements, coupled in four wooden boxes, each containing two elements of six positive and seven negatives of 15 centimeters by 18 centimeters. The elements rest on strips of rubber. Their capacity is 108 ampere hours at 15 volts and 18 amperes of maximum discharge. Total weight 170 kilograms. The high intensity of the charging current—18 amperes—which this new plate will permit is looked upon as a great advantage, inasmuch as but six hours in place of 22 is required for charging, the latter being the time required by that form used in the telegraph service.

An interesting innovation is mentioned by which the accumulators are not only made to serve the train lamps but to light the stations as well. For this purpose the first and last passenger coach is furnished on either side with an arm, which, on being lowered cuts into circuit a lamp of 20 candle power. All waste of current is prevented by a special switch in each compartment, which can only be controlled by the conductor. The system seems admirably adapted to trains which carry few passengers, and the illumination of the stations and cars is better and less expensive by this process.

It is generally understood that accumulators can stand, without shortening their life, a forced discharge for a short time. This question has been carefully studied, and as a result the doctor advises that only about two-thirds of the accumulators' capacity should be withdrawn where these are liable to sudden strained efforts.

These experiments have been confirmed by similar ones at Carlsruhe. A battery was wanted for the handling of an electric crane in the port of Mannheim, and a battery of elements capable of discharging 1,000 amperes was demanded. The experiments, which were continued through three months, showed that a discharge of double or even triple the normal rate had no deleterious effect on the accumulators under trial. Further tests, up to a discharge of 5,300 amperes, were made, a limit beyond which the temporary measuring apparatus could not go. Subsequently the elements were put in short-circuit through the line conductors for 48 hours; in short, every attempt was made to break down the batteries. Those of the Cologne company were proof. On being examined after three months' service, no change was noticeable. They were perfectly plain as to surface and the active matter had not loosened its hold.

## A Proposition from Madison, Ind.

The city of Madison, Ind., located on the Ohio river 50 miles above Louisville, invites capital to come to Madison and erect an electric lighting plant and an electric street railway, purchase from the city its present lighting plant, and purchase for a nominal price the existing street railway system and convert it into an electric street railway. In return the city of Madison proposes to give a 10-year contract for lighting the streets of the city with from 100 to 125 2,000 candle power arc lamps; lamps to burn all night and every night. The city will also grant a 10-year franchise for commercial lighting, and upon surrender of the street railway franchise, the city of Madison agrees to grant a liberal electrical street railway franchise for the term of 30 years from the date of the contract between the city and the successful bidder, the franchise to contain proper safeguards for the city's interest. Those receiving lighting contract and franchise should purchase the present lighting plant as it stands, for a sum of money to be set forth in their proposition. The same persons who are to receive the franchise for the extension of the street railway shall purchase the existing street railway system and existing franchise, good will, etc., from the present owners for the sum of $2,500, and shall specifically agree so to do in proposition submitted to the city. Bids must be made to George B. Clark, clerk of the city of Madison, by 7 P. M. on April 8th, at which time they will be opened. Pierce & Richardson of Chicago, the engineers for the city, can give further information.

## The News in Charlevoix, Mich.

The *Charlevoix Sentinel* contained several news announcements recently that will be of interest to readers of the WESTERN ELECTRICIAN. One is the proposed establishment of an electric railway in the village. Charles Gabriel and his associates have asked for a franchise for 30 years for an overhead trolley line that may ultimately be extended to Petoskey and Harbor Springs. The *Sentinel* heartily favored the passage of the ordinance and had this to say of Mr Gabriel: "He is a citizen of Charlevoix, and is wide awake in everything that concerns the prosperity of the town. There is no more capable electrician in Michigan than he. He is the man for the hour."

Considerable space is devoted to a description of the local lighting plant. This is so good that the temptation to reproduce it is irresistible. The title is "Volts and Amperes.—Mr. Chas. Gabriel's Electricity Mill Turning Out a Good Quality of That Class of Goods." The text of the article, unaltered and unabridged, is as follows:

Few who walk under the arc lights or read their paper by the beautiful white light of the incandescent give a thought to the source from whence comes this mysterious thing that in nature rends the clouds and illuminates the heavens.

Down at the power house of the Charlevoix Electric Co. they have a large quantity of this element under subjection, sending it, red-hot, in quantities to suit purchasers, anywhere within the corporate limits of the village of Charlevoix. How do they do it? This is the way, according to Charley Gabriel's story:

First, the motive power is a Ball, high-speed, automatic engine, of 175 horse power, making 275 revolutions per minute. It is a handsome thing, bright and shining, and as quiet and unassuming as the gentleman whom we found brightening up the nickel trimmings—Mr. Patrick Closson, the engineer, a member of the Saginaw Association of Stationary Engineers, and who also has charge of the dynamos.

The machines that create, or, rather, concentrate the illuminating current, are a 75 kelo-watt, two phase, alternating generator, of 7,200 alternations per minute, with a Westinghouse six kelo-watt multo-polar, direct current generator, used as an exciter. The direct current is generated in this and passed into the field-coils of the alternating current machine.

This resistless and deadly power must be controlled and directed. It must supply the prescribed volume of light to forestall kicks from the patrons, and it must be kept from "slopping over," thereby burning out sensitive connections. To render this duty easy, a large switch-board stands against the wall, containing appliances for that purpose. The switch-board is equipped with an ammeter, for measuring volume of current, a potential indicator, for measuring pressure of current, lightning arresters, cut-outs, rheostats and switches.

The system is alternating, of 2,000 volts electro-motor force. Being also an induction system, there is no metalic connection whatever between the current generated by the machines and the wires that enter the buildings. The electro-motor force is reduced from 2,000 to 100 volts by converters, placed at intervals upon the poles. Those iron boxes which you see upon the poles contain two sets of coils, entirely separate from each other, one receiving the primary voltage and conveying it to the secondary only by induction. Were it not for this conversion, every carbon and fuse in the system would be burned to a cinder.

It has been observed by outsiders conversant with electrical matters that the control of the current in the Charlevoix system is remarkable, in the even distribution of candle power. This result is obtained by a complete secondary system, reaching to all parts of the lighting district, and fed at intervals by the primary circuit.

The street lighting system consists of 15 arc-lamps, of 2,000 candle-power each. There are four commercial arcs the same power, and 500 sixteen candle-power incandescents now installed. About fifteen miles of wire is used.

The power-house and office, combined, is a model in every detail. Everything is clean, bright and orderly, and Manger Gabriel says there is not a better equipped electric lighting lighting plant in the state.

Charlevoix has many things to be proud of, but nothing we can point to with greater satisfaction than its electric lighting system.

The same issue of the *Sentinel* contained two items which throw an interesting light on the customs of Charlevoix:

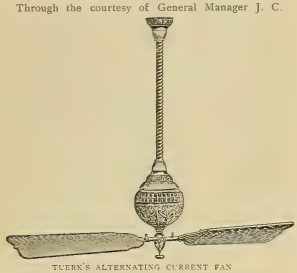
—Beginning to-night, the water-works whistle will take the place of the court house bell, as a curfew.

—Some person, to us unknown, left a box of elegant cigars on our desk in our absence from the sanctum yesterday. Whoever it was, may heaven's choicest blessings be showered into his lap.

## Tuerk's Alternating Current Fan.

After nearly five years of experiment and study, the Tuerk Water Meter company of Fulton, N. Y., offers the alternating current ceiling fan herewith illustrated as the result of its hard earned experience, confident that this piece of apparatus will meet all requirements and give satisfactory service to users.

Through the courtesy of General Manager J. C. Hunter, a representative of the WESTERN ELECTRICIAN was recently shown through the large factory of this company. He saw many alternating fans while subjected to the severest tests before shipment. Numerous testimonials from various parts of the country show that the work is in all respects satisfactory. That success is assured may be assumed from the fact that arrangements are now being made to extend the present facilities, to meet the demand for ceiling fans. The company makes both direct and alternating current fans, and fully guarantees each piece of apparatus as it leaves the factory. All bearings are self oiling. The fans are supplied with handsome figured magnolia blades with the finest finish and a blade adjuster which admits of the blades being changed to any angle without stopping or changing speed. Thus the current of air can be thrown up or down—a feature said to be possessed by no other fan. The Tuerk company is looking forward to a large western trade, especially with the alternating current fan.



TUERK'S ALTERNATING CURRENT FAN.

According to advices received on March 14th by which citizens of Waterloo, Iowa, take $57,000 worth of real estate, and L. S. Cass of Sumner, J. H. Bowlan of Waverly, C. J. Fosselman of Waverly and J. H. Rafferty of Oelwein invest $150,000 in 16½ miles of electric railway in Waterloo, connecting with Cedar Falls, seven miles distant. Bids for construction will be received at once and the road is to be in operation within 15 days.

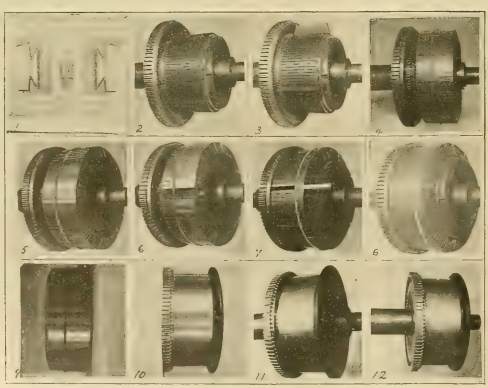
## Painter-Morrison Detachable Segment Commutator.

The illustrations show an invention which contemplates a radical change in the construction and building of commutators. Here are some of the claims made by the inventors, G. E. Painter and J. F. Morrison of Baltimore.

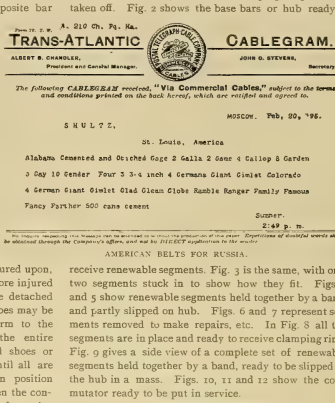
The object is to secure all the advantages which could possibly accrue from the use of composite bar segments with certain other valuable results. This commutator has contact shoes mounted in a novel manner upon base bars, resulting in a reliable, effective and durable electric conductivity from the usual brushes, through the shoes to the base bars, thence to their winding connections. The latter are never disturbed, except for repairing the armature windings. The lead wires of the armature are soldered fast to the base bar or hub, in much the same way as at present; none, however, have to be disconnected for renewals. This in itself effects a great saving in time, and prevents injury to the insulation of the lead wires.

Additional novel and important results are that the contact shoes, with their insulation, may be applied in mass to, and secured upon, the hub, although, if desired, any one or more injured or defective contact bars or shoes may be detached without disturbing the others, and new shoes may be inserted which have been made to conform to the reduced worn dimensions. So, also, if the entire commutator is to be re-clad, the several shoes or contact bars may be applied one by one until all are in place, and then all of them secured in position by the clamping device common to all. When the contact or shoe bars are applied in mass, only a few minutes will be required for removing a set of worn-out ones and substituting a new set. Or if a shoe or two should become injured, say from the falling of a wrench or by burning out, they can be readily removed and new ones substituted without even loosening the journal boxes or armature shaft, if, as is usual, enough space has been provided for between the end of commutator and journal box. This is a great saving to those who have small plants with no duplicate parts. The shoe bars are as firmly clamped to the base bar as the latter is clamped to the hub, and the clamping force is so applied as to secure good, metallic contact between the shoes and base bars. The cost of renewing the detachable segment commutator is said to be about one-third of the cost with the present style.

The several views in the illustration are taken from a Westinghouse No. 3 street car motor commutator and show it in various degrees of completion. This commutator is now running every day on the Baltimore Traction company's Carey street line, and has made so far over 14,000 miles, without any attention except that, after going some 5,000 miles, it was taken out for examination and turned up. The segments were found to be just as tight as the day it went into service. The commutator is nine inches in diameter, and has 95 sections or segments. Fig. 1 is a sectional view, showing the manner in which the segments are held in place. It will be seen that the base nut, which holds the inner bar or hub together, need, and must, not be taken off to renew outer bars; only the outer clamping ring need be taken off. Fig. 2 shows the base bars or hub ready to receive renewable segments. Fig. 3 is the same, with only two segments stuck in to show how they fit. Figs. 4 and 5 show renewable segments held together by a band, and partly slipped on hub. Figs. 6 and 7 represent segments removed to make repairs, etc. In Fig. 8 all the segments are in place and ready to receive clamping ring. Fig. 9 gives a side view of a complete set of renewable segments held together by a band, ready to be slipped on the hub in a mass. Figs. 10, 11 and 12 show the commutator ready to be put in service.



FIGS. 1 TO 12. PAINTER MORRISON PETVAHABLE SEGMENT COMMUTATOR.



Form 12. P. M. A. 210 Ch., Pd., Ma.

TRANS-ATLANTIC CABLEGRAM.

ALBERT B. CHANDLER, President and Cardial Manager. JOHN O. STEVENS, Secretary.

*The following* **CABLEGRAM** *received,* **"Via Commercial Cables,"** *subject to the terms and conditions printed on the back hereof, which are assisted and agreed to.*

MOSCOW. Feb, 20, '96.

S H U L T Z,

St. Louis, America

Alabama Cemented and Otched Gage 2 Galla 2 Gane 4 Gallop 8 Garden 3 Gay 10 Gender Four 3 3-4 inch 4 Germans Giant Gimlet Colorado 4 German Giant Gimlet Glad Gleam Globe Ramble Ranger Family Famous Fancy Farther 500 cans cement

Sumner.

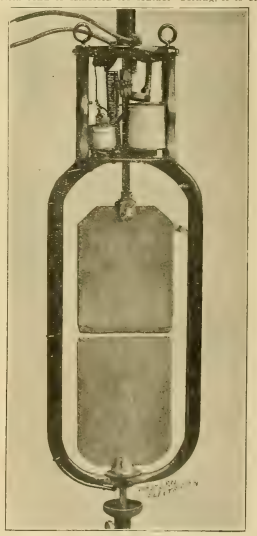
2:49 p. m.

*No liability whatever for mistakes or delays in the transmission of this cable. Repetitions of doubtful words should be obtained through the Company's office, and will be DIRECT application to the sender.*

AMERICAN BELTS FOR RUSSIA.

## American Belts for Russia.

When the government and manufacturers in far away Russia send to America for leather belting, it is certainly an indication that the belts are good, and when a single order is cabled for 17,000 feet, it further shows that the Russians want a lot of a good thing. The interesting cablegram reproduced herewith was received from Moscow by the Shultz Belting company, St. Louis, on February 20th, and, being interpreted, calls for 17,000 feet of Shultz belting, assorted sizes. In the same month an order was received from Sweden for 4,200 feet, assorted sizes. The foreign trade of this concern is very large and includes also distributing depots in Lon-



WIEMANN'S NEW ARC LAMP.

don, Australia, Johannesburg, Africa, Brussels, Moscow and Malmo, Sweden. There are also Shultz agencies in 20 of the leading cities of this country. The strictly high grade of the Shultz belts, their lasting qualities and uniform standard of excellence, have made them justly famous in all parts of the world.

## Law Battery Specialties.

Some interesting specialties have been recently placed on the market by the Law Battery company of New York. Two of them are illustrated by the accompany

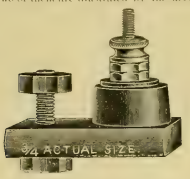



FIG. 1. LAW BATTERY SPECIALTIES.

ing cuts. The device shown in varying relations in Figs. 1, 2 and 3 will undoubtedly be highly appreciated, as by its use corrosion between the metal parts of a battery cell is said to be an utter impossibility. Fig. 1 is a general view of this appliance and Fig. 2 shows a section. Referring to the latter, *A* is the screw, *B* the thumb-nut, *C C* stationary nuts, *D* hard rubber, *E* dense carbon, *F* wax and *G* pure tin. It will be seen that the current passes from carbon to metal through interior surfaces only, where moisture and air cannot penetrate, and that no portion of it can pass through or over the exterior surfaces, where moisture and air are always present and ready to organize a local miniature battery with, of course, corrosion of the metal. This connector is designed for use on all primary cells having carbon plates for the negative elements, in manner as shown by Fig. 3.

The well-known double cylinder and honeycomb cells manufactured by the Law company are provided with connectors that also entail the passage of the current through interior surfaces. These are in the form of screws made of carbon, and screw down through porcelain covers into (in the former case) a double cylinder threaded to receive it and (in the honeycomb cell) into a perforated carbon block, also threaded.

Fig. 4 represents a new controlling apparatus, mostly used in connection with electro therapeutical work. The old style switchboards, with their mass of wires, may be entirely supplanted by it, and it is so simple to operate that a child can manipulate it. The cut clearly depicts it. This controller consists of two triangular shaped carbon plates, each carrying a bit of sponge at one of its angles, and so mounted over a small glass jar of water, that by means of a worm-gear operated by a hand wheel, the sponge tips are gradually moved down

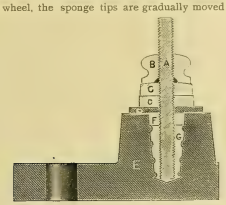



FIG. 2. LAW BATTERY SPECIALTIES.

into the water and toward each other until the plates touch at their lowest points.

## Wiemann's New Arc Lamp.

William P. Wiemann of Washington, Pa., has devised the improved arc lamp for constant current which is shown on page 140. This lamp is of the single rod type, using flat carbon plates. The feed of the rod is controlled by the T-shaped lever, which has an armature operating over the cores of the regulating coils. The main adjusting spring for regulating the clutch is released at different points as the carbon is consumed by coming in contact with the tapered end of the compensating lever, which moves in a tapered slot in the rod. As the carbon rod descends, the feeding point is adjusted higher, being highest when the carbons are consumed and lowest when newly trimmed. As the weight of the carbons is thus compensated for, it is possible to build arc lamps to run many hundred hours if desired, and maintain a proper arc throughout, but as the globe should be cleaned frequently, 100 hours is thought to be the proper run with one trimming. The photograph from which the picture was made was taken after 12 hours' burning, the complete run being 108 hours. In this instance the arc traveled steadily from side to side, the voltage remaining 50 with current of nine amperes throughout the run.

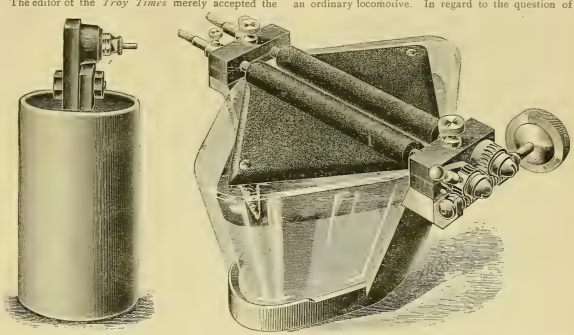
The advantages claimed for the lamp are: A proper arc at all times, a positive start, cheapness of trimming and carbons, very little shadow, simple construction and an even load on the dynamo.

The inventor, Mr. Wiemann, was born 1863, in Allegheny, Pa., and began his electrical career with the H. P. Brown Electric company of Pittsburg in 1886. Shortly after he went with the Westinghouse company as traveling electrical engineer, remaining in this position until three years ago, when he became connected with the Washington Electric Light & Power company.

## Rontgen's Discovery.

The *Troy Times* is one of those newspapers that refuse to Professor Röntgen the great honor that belongs to him. It speaks of the novel and powerful force discovered by him as "X-rays." *Rochester Herald*

The editor of the *Troy Times* merely accepted the



FIGS. 3 AND 4 LAW BATTERY SPECIALTIES

suggestion of Professor Röntgen, who himself referred to his discovery as "X-rays." Here are the distinguished scientist's words: "For brevity's sake I should like to use the expression 'rays,' and to distinguish these from other rays I will call them 'X-rays.'" Again, was it a "novel and powerful force" or a manifestation of a form of energy?

## Sciagraph of the German Emperor's Arm.

It is announced that an experiment with X-rays upon Emperor William's arm has revealed the nature of the malformation. The sciagraph taken is said to have been submitted to eminent surgeons, who are reported to have expressed the belief that a simple operation will restore the partial if not complete use of the arm and hand.

## National Electric Light Association.

The New England Passenger association has granted a rate of a fare and one-third, on the certificate plan, from all points in that territory to New York and return, for all delegates and representatives attending the nineteenth convention of the National Electric Light association, to be held in New York on May 5th, 6th and 7th.

## Medical Treatment by Telephone.

To General A. C. McClurg of Chicago belongs the credit of putting the telephone to a new use. General McClurg is now in Europe rapidly recovering his health. A few months ago it was thought he had but a few weeks to live. The change in his condition is due to the telephone and a New York doctor, says the *Chicago Times-Herald*.

General McClurg was suffering from some affection of the head, and, although everything possible was done for him, nothing availed. Finally he was urged to summon to Chicago a New York doctor, who had made a wonderful success in the cure of similar diseases. A telegram was sent offering the New Yorker a tremendous fee to come to Chicago, but the answer was that he could not come at any price, as he had patients whom it was impossible to leave.

"Can you treat me by telephone?" wired back General McClurg.

An affirmative answer came, and that night the New York physician and McClurg's doctor had a long conference over the long distance telephone, one end of which was in the sick man's bedroom.

"What are the symptoms?" asked New York.

"Pain in the cerebellum, drowsiness in the morning," replied Chicago, and then, continuing, described the exact condition of the patient.

The conversation lasted for more than an hour, and the New York doctor advised change in the treatment.

General McClurg improved under the new regime, and in a few nights was able to talk to New York himself. This method of treatment was followed for a month, and the patient improved so much that he was then able to go to New York, where he saw his doctor for the first time.

## Electricity for High-speed Railroad Trains.

If we wish to obtain higher speeds on railroads, we must employ more power in proportion to weight than we now have at our disposal with the modern steam-driven locomotive. In order to greatly increase the power, it is necessary that the source of energy should be stationary and the energy transmitted to the moving train, and the only practical way of accomplishing this on a large scale is by employing electricity. An electric engine may be made to develop almost any amount of power, and still be well within the weight and bulk of an ordinary locomotive. In regard to the question of supplying a long road with a powerful high tension current, Hiram S. Maxim points out in *Cassier's Magazine* that when trains are propelled by steam it is necessary to employ a large number of separate steam engines. Why, then, should there be any objection to using a large number of engines for an electrical railroad? It certainly costs no more to run a stationary engine than a locomotive engine, and the engines for supplying the current could be placed at regular intervals along the line. The tension of the current might be, say, from 2,000 to 5,000 volts. The main conductors should be thoroughly insulated and protected from atmospheric influences. The actual rubbing surface, transmitting the current to the moving train, should be in relatively short sections, and connected to the main conductor only while the train is actually passing, the latter being provided with suitable apparatus for switching the current in ahead of the train and cutting it out after the train had passed. In this manner there would be very little loss of current, even if at a very high tension, and nearly all danger of accidents would be avoided.

With the present steam engines it is necessary to use the very best quality of coal, costing at least twice as much per ton as the cheap coal. A locomotive steam engine has, of necessity, to be a high-pressure, non-condensing engine, and the exhaust steam has to be discharged against considerably more than an atmosphere of pressure, because it has to be employed for inducing the draft. Moreover, for reasons before stated, a locomotive engine must be limited in size.

A stationary engine, however, may be made of any size. It may be a compound condensing or a triple-expansion engine. Large boilers may be employed, having a very large heating surface in proportion to the coal consumed and the grate surface may be of any size, so that a very cheap coal may be employed. In this manner the cost of developing a given horse power costs 60 per cent. less than it does on the locomotive.

Among the latest claimants for recognition in the field of electrical literature is the *Station*, a Rochester publication which, as its name implies, is intended for men in charge of electrical plants. It is a monthly magazine and has many attractive features.

## New Electric Lightship.

The first electric lightship built in this country is the one now on the Sandy Hook station; the second is building at Bath, Me., and she will be known as light vessel 66. By an odd coincidence in figures, remarks the New York *Sun*, her contract price is $66,000. She is for the Boston station and will be launched some time in April. This torch-bearing vessel is of composite construction, wood and steel entering about equally into her hull, this build being more durable, easier to take care of, and safer in case of grounding than one of all metal. Her dimensions are: Length, 66 feet; breadth, 28½ feet; depth, 13 feet.

From the masthead two bunches of red light will warn the mariners of dangerous water. There will be four 110 volt 200 candle power lights at each masthead, enveloped in red glass, which will be about 43 feet above sea level. The extreme length of her masts will be 67 feet, including an 11-foot topmast on each. The masts will be made of iron 16 inches in diameter at the thickest part. Wire rigging will be used, and enough sail will be bent on to give her steerage way in case she is torn from her anchorage.

In addition to a spread of canvas the lightship will be equipped with a 300 horse power engine, two boilers of the Scotch type, 300 horse power each, and two donkey engines for hoisting purposes. Her screw is four-bladed, eight feet in diameter, and of composition. She will be moored with a 5,000-pound anchor. The vessel will be eqipped with two lifeboats and additional anchors, a powerful steam siren fog whistle and a 1,000-pound bell. A mate to this vessel is being built in San Francisco for use on the Pacific coast.

## Electric Hand Lamps.

A number of electric hand lamps of various sizes and shapes have been patented and are constructed by an electrical engineer in Vienna. These lamps come in the shape of bottles, clocks, opera glasses; in fact, in any desired shape, but are all constructed after the same principle. The neck of the bottle contains a small battery in which three pairs of platinum and zinc elements of the smallest possible size are concealed. This battery is said to furnish a current of from four to ten amperes at six volts. A minute incandescent lamp is connected with the poles of the battery, and protected by a knob of cut glass, the lower part of which is silvered and acts as a reflector. The body of the bottle contains the reservoir, in which the battery solution is kept. When the light is to be used the top containing the battery is screwed off and the bottle is filled about half way with the fluid. When the top is screwed on again tightly the lamp is ready for use. As soon as it is inclined so that the fluid reaches the battery the current is generated and the incandescent lamp glows with a brilliant light. No sooner is the bottle replaced in a vertical position than the light will be extinguished. When the lamp is not in use there is no waste of material, and the smallest sized bottle will furnish a continuous light for about half an hour. The inventor furnishes with the lamp a bottle of fluid sufficient for eight fillings at a cost of 50 cents.

## Getting Ready the Sandbag.

[From the *Chicago Evening Journal*.]

There was a demonstration of aldermanic hindsight plus aldermanic foresight at the Council meeting last night. The hindsight was revealed in that clarified vision of what might have been done when numerous trolley franchises were bestowed upon the street railway companies. Apparently the innocent city fathers had just awakened from a long sleep to discover that during their hypnotic state they had been the unconscious agents of Mr. Yerkes and Mr. Wheeler. Unofficial Chicago wondered all the time why it was that conditions for an underground system were not included in those franchises. The press even suggested in its mild way that it was the duty of the aldermen to make those conditions imperative. It argued that they could be forced upon the railroad companies, owing to their eagerness to obtain the valuable grants. But the hypnotized fathers said naught and in their dreams let slip the city's opportunity.

It has been hinted, however, that they were still conscious enough not to let slip their own opportunity, and that brings us to the second part of our story, or the foresight displayed at last night's meeting. Having got from the companies what they could in the first instance, they now cook up a little scheme of the sandbagging order, for the purpose of doubling their receipts. That is why the public will not sustain them, although the public is overwhelmingly in favor of underground wires. The time to have insisted against the overhead trolley was when these curious protestants were allowing it to be generally introduced. Their change of heart is suspicious.

## Overhead Trolley Agitation in London.

[From the *Electrician*.]

The decision of the London County Council, notwithstanding Earl Russell's weighty arguments, to again oppose the bill of the London United Tramways company, in which power is sought to make use of the overhead trolley, is a typical instance of the gratuitous obstacles that are in the enlightened country placed in the way of tramway improvement. Insecure tenure, lack of capital and contentious traffic are too often the lot of our English tramway concerns, and are in themselves almost sufficient to entail upon the introduction of improved methods of traction. The London County Council however, with a grand display of bigoty anxiety about the beauty of London, preferred to make quite sure that a capitalist concern should in no way prosper, and summarily vetoed a system of traction which has found favor not merely in far away America but in Bristol and Coventry and in many Continental cities, where the beauty of the streets is generally considered to exceed even the elusive charm of the Uxbridge-road from Shepherd's Bush outward. We yield to no one in a desire that engineering "improvements" should not be permitted to further disfigure the metropolis of the empire; but high as is our opinion of the capabilities of the modern engineer, we must confess we never thought him capable of disfiguring the many dreary roads that lead out of London. By all means insist, if need be, on a conduit system in the central portions of London; but why refuse the inhabitants of Shepherd's Bush the boon of getting away from their dismal surroundings as fast as the electric car can take them; they are the persons most concerned, and by all accounts do not object to the proposed innovation. The overhead trolley, whatever its demerits —mechanical, electrical or esthetic—and they are many,—will always be the cheapest to erect, and, therefore, so long as our tramways are in the hands of companies liable to be bought out on onerous terms by the local authorities, this single advantage will rightly carry great weight, and should in all fairness and in all good sense be allowed to do so. When tramways are laid down by philanthropists, it will be time enough to expect a lavish capital outlay without thought of return.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, March 14.—The principal electrical news of the week clusters about the conference of General Electric and Westinghouse directors in this city on Thursday. This meeting resulted in important action which will undoubtedly have a great influence on the future of the electrical business of the country. An agreement for co-operation in relation to patents was reached, and the following official statement was issued:

Negotiations between the General Electric company and the Westinghouse Electric & Manufacturing company have resulted in an arrangement with respect to a joint use of the patents of the two companies, subject to existing licenses, on terms which are considered mutually advantageous.

It has been agreed that after certain exclusions the General Electric company has contributed 62½ per cent. and the Westinghouse Electric & Manufacturing company 37½ per cent. in value of the combined patents, and each company is licensed to use the patents of the other company, except as to the matters excluded, each paying royalty for any use of the combined patents in excess of the value of its contribution to the patents.

The patents are to be managed by a board of control, consisting of five members, two appointed by each company, and the fifth selected by the four so appointed. Both companies have acquired during their existence a large number of valuable patents and numerous suits have been instituted in consequence of the infringement of these patents by one party or the other, or by their customers. In the prosecution of these suits large sums of money have been expended and the general expenses of the companies have in this manner been greatly increased. It is expected that the economies to be effected will be very considerable and that the two companies and their customers will be mutually protected.

The especial incentives which led to the arrangement made at this time were the recent decisions in favor of patents of the General Electric company controlling the overhead system of electric railways, the approaching trials of a number of other important General Electric patents on controllers and details of electric railway apparatus and systems and other electrical devices, and the equally strong position of the Westinghouse company in respect to many important patents held by patents of Nikola Tesla, and, in view of its other patents in active litigation, some of which are of controlling importance.

Although nothing was touched upon in the official statement save the patent question, there is no doubt that this important agreement will stiffen prices for the products of the two companies and lead to a more friendly feeling generally. The effect on the smaller electrical manufacturing companies remains to be seen, and the situation will cause many an electrical man much anxious thought. The agreement has had a very beneficial effect on General Electric stock, which has been advancing slowly of late on optimistic rumors and also probably in anticipation of the present pooling action. A month ago the stock was selling at about 25; it closed to-day at 36⅞.

President Charles A. Coffin of the General Electric company said in a newspaper interview:

Although the statement which has been given out does not happen to say so in so many words, the arrangement between the two companies has been formally approved by the directors of both companies. The agreement is as yet in skeleton form. It will take several weeks to complete it. I should say it might, perhaps, be perfected and put into effect by June 1st. It is the intention that it shall continue during the life of the patents of the companies. The patents which are excluded are foreign patents which cannot be embraced and patents on cable and underground railway materials, which are covered by licenses. The companies will stop fighting each other in the courts, and will join in prosecuting infringements of their patents. How much will be saved by the termination of litigation I cannot say, as all legal expenses are included in one account. It would be necessary to separate the items to furnish actual figures. The saving, however, will be large. No monopoly of the electrical business will be created by the agreement. There are other important concerns in the business. The General Electric and Westinghouse companies do not consolidate. They retain their entire independence, and will, in fact, as heretofore, be competitors in business. Prices will doubtless be agreed upon which will benefit customers of the companies and the companies themselves, but there is no intention of establishing high prices for electrical apparatus and supplies. It has not yet been figured out how much the revenues of the companies will be increased by the arrangement, nor can it be until the arrangement has been put in more perfect form. The first proposition for an agreement between the companies was made some five years ago, but the negotiations which resulted in the agreement were opened recently.

Nathaniel W. Pratt, a well-known engineer and inventor, died on Tuesday last, at his home in Brooklyn. Mr. Pratt was born in Baltimore, in 1852. He was at one time consulting engineer to the Dynamite Gun company, and under his designs and patents the first successful dynamite gun was built. At the time of his death he was president of the Babcock & Wilcox company, and a member of the American Society of Mechanical Engineers, American Institute of Mining Engineers, American Naval Institute and the Engineers' Club, of this city. He leaves an aged father and mother, a widow and three children. W. F. O.

## Northwestern Notations.

MINNEAPOLIS, March 14.—The aldermen of Little Falls, Minn., voted to annul the contract with the light and water company a short time since, and have now notified the company that after April 1st all light furnished must be under an express contract, which means practically that, after cancelling the contract, they allow it to continue, and offer to make a new one at the date mentioned.

The council of Sleepy Eye, Minn., has contracted with the Fort Wayne Electric corporation to exchange one of the dynamos for an alternator for an incandescent system, with 750 lights capacity. The town will have to be rewired for incandescent lights.

The trustees of Alta, Iowa, have contracted with a Chicago firm for an electric light plant and with a Galesburg, Ill., firm for a steam power plant.

Alden, Iowa, wants electric lights. A canvass shows that 300 lights would be taken.

The council of Great Falls, Mont., voted to take bids for 60 days for furnishing 42 arc lights of 2,000 candle power, for a term of three or five years, or their equivalent in acetylene or gas.

The litigation for the possession of the Electric Light and Power company property at Fond du Lac, Wis., has ceased, H. F. Whitcomb of Milwaukee and ex-Governor W. R. Merriam of St. Paul purchasing it. An electric street car line will probably be built this summer.

The Janesville Street Railway company of Janesville, Wis., will resume operating its cars soon. They have been idle for several months.

When the Postal Telegraph company entered Clinton, Iowa, it put in call boxes, which the Western Union had not done. The latter started to do likewise, but did not get permission to erect poles and wires, and was ordered to stop by the city officials. The company persisted, and the mayor ordered out the fire department and threatened to cut the wires, when it desisted.

The council of New Ulm, Minn., is considering whether to contract with the local light company for street light, or put in a municipal plant.

The Winona Railway & Light company has been organized under the laws of Virginia for the supposed purpose of purchasing the plant of the General Electric company of Winona, Minn., which is to be sold at receiver's sale April 30th, when the new company will hold its meeting to elect directors. F. B. Kellogg, C. A. Severance and F. A. Seymour of St. Paul and M. B. Webber and E. Lees of Winona are stockholders. M. F.

## Milwaukee, Wis.

MILWAUKEE, March 14.—The Milwaukee & Wauwatosa Motor Railway company has passed into the hands of a syndicate represented by J. R. McDonald of Detroit and Edward B. Gallaher of New York. It is proposed to convert the line into an electric system and to extend it to Waukesha and Oconomowoc. The new owners will also try to get an entrance into Milwaukee. They have organized the Milwaukee & Waukesha Rail-

way company with a capital stock of $1,000,000. Mr. Gallaher, who is the chief engineer of the company, states that an entirely new track to Wauwatosa will be built and that the line will be equipped with the most modern 35-foot cars. The company already has a right of way to Waukesha, and Mr Gallaher says that if it gets an entrance into the city, it will also build a line to Whitefish Bay, the right of way to be obtained by condemnation proceedings. It is the North Greenfield line that will be extended to Waukesha and it will connect with the Wauwatosa branch at the Grand avenue viaduct. The route that the new company wants to follow in building lines in the city is said to have been mapped out. One line is the present tracks of the old company on Wells street. Another is on Lincoln avenue, from the western city limits to First avenue; north on First avenue and over the First avenue and Sixth street viaduct to Sixth street, thence to Clybourn, thence to Fifth and thence to Locust street, where the line will branch, one spur going to Lake park, probably across the new bridge at Folsom place, and the other spur running west to the West Side parks.

Considerable interest is being taken in the new project to build an inter-urban line between Kenosha and Milwaukee. The town board of the town of Oak Creek has granted the Milwaukee, Racine & Kenosha Electric Railway company a franchise to build clear through that township. It is said that with this franchise the company has a right of way from Kenosha to Milwaukee and that early in the spring the work of building the line will be commenced. It is even held out that cars will be running by next fall. The fares are to be low, the Oak Creek franchise stipulating that not more than five cents shall be charged within the limits of the town, which is six miles square. It will be a single-track system and will be built along the Chicago road. There will be side tracks and stations at convenient points, and the cars will stop at every crossroad when desired. The Oak Creek franchise runs for 50 years, and it is provided that work upon the line must be commenced within 18 months, otherwise the franchise will be forfeited. The company, which has been incorporated under the laws of Wisconsin, has a capital stock of $100,000. At Racine, it is said, the company will run its cars over the lines of the Racine Electric Railway company, and from Cudahy into Milwaukee it is given out that the lines of the Milwaukee Electric Railway & Light company will be used. The chief promoters of the enterprise are Matthew Slush of Mt. Clemens, Mich., who is president; A. W. Bishop of Cleveland, who is vice-president and treasurer, and Thomas M. Carney, who is secretary. The success of the enterprise may mean an electric railway from Chicago to Milwaukee. It is not expected that the through travel between Milwaukee and Chicago would be very heavy, after the novelty of such a line had worn off, but it is estimated that the local traffic would be large.

C.

## PERSONAL

Thomas R. Taltavall, editor and half owner of the *Electrical Age* of New York, has sold out his interest in that journal and on Saturday last resigned as its editor. Mr. Taltavall has been connected with the *Age* six years.

C. O. Baker, Jr., of Baker & Co., Newark, N. J., and the widely known master of transportation of the National Electric Light association, was in Chicago on Monday. Mr. Baker thinks that the prospects for a successful exhibition in New York in May are very encouraging.

## ELECTRIC LIGHTING.

Portland, Mich., will issue bonds for $15,000 for electric lighting plant and dam.

The village of Hart, Mich., has voted to issue bonds for $18,000 for electric lights and water works.

The new board of Dexter, Mich., elected recently, is favorable to the introduction of electric lights and other improvements.

A large number of bids for furnishing machinery, wire and supplies for the new arc lighting plant in Lincoln Park, Chicago, were opened by the commissioners on March 14th. The bids were ordered tabulated for further consideration on March 18th.

The city of Utica, N. Y., has been considering the question of establishing a municipal lighting plant and a report on the subject has been prepared by Montgomery H. Johnson, but it is hardly possible that the council will feel warranted in making the large investment required for a modern plant. Mr. Johnson estimates that the plant would cost $161,441.45.

Rheubottom & Bond of Union City, Mich., have completed a central station plant at Bronson, Mich., and turned it over to the Bronson Electric company. This plant is an innovation in that section, power being supplied from a gasoline engine. The lights are pronounced unusually good, both arc and incandescent being in operation. The engine was furnished by the Otto Gas Engine Works, Philadelphia, and the dynamos by the United Electric Improvement company of the same city.

## ELECTRIC RAILWAYS.

It is the present expectation to have the Chicago Lake Street "L" road operated by electricity by May 1st This will result in a saving of not less than 10 per cent in operating expenses. Mr Louderback estimates that on the present passenger traffic of the line and using electricity as motive power the road will a little more than pay all fixed charges.

By the collapse of the government bridge across the Mississippi river at Rock Island the Davenport, Iowa, street railway was tied up, as the main feed wires from the power house in Moline, Ill., were broken and carried down. The accident was caused by the ice, which had gorged a mile east of the bridge, and which suddenly broke and rushed with tremendous force against the bridge.

The Syracuse, N. Y., Street Railway company went into receivers' hands on March 7th. Justice Hiscock, in the Supreme Court, on application of stockholders, appointed Edward E. Judson, Jr., and W. Judson Smith receivers. This voluntary action was taken for the purpose of the reorganization and consolidation of all the street railways in Syracuse into one system. The company's floating indebtedness and other obligations aggregate about $1,000,000. A mortgage for $2,500,000, held by the State Trust company, of New York city, will be foreclosed.

The North Chicago Electric Street Railroad company will build at once a cross-town line on Lawrence avenue from the line of the Northwestern elevated railroad to Milwaukee avenue. It is proposed to have this line for a feeder for the elevated road, as well as the North Chicago system, and to collect two fares for a trip from the section of the city reached to the down-town district when passengers transfer to the elevated. The new line will be between five and six miles in length, and except for the north and south lines, it will run through a territory which now has no facilities whatever. It is the present intention to begin work on the new line within the next four weeks and to have it in operation by July 1st. The same company will build a line on Montrose boulevard, from Evanston avenue to Milwaukee avenue. This will prove a valuable feeder for the Northwestern road. Both lines will serve as feeders for the North Chicago system, and only one fare will be charged for a trip down-town over the electric road and the cable lines.

## TELEGRAPH.

The Western Union Telegraph company announces that the River Amazon cables between Para and Manaos are completed. Offices will be opened at Carmeta, Mosqueiro, Pinheiros, Source, Breves, Gurupa, Chaves, Macapa, Monte Alegre, Santarem, Alemquer, Obidos, Parintius, Itasatiara and Manaos. The terminal stations are the only ones open at present.

## POWER TRANSMISSION.

New York capitalists have received pledges for 2,600 horse power from Utica enterprises for a proposed electric power transmission scheme at Trenton Falls.

The power plant of S. D. Warren & Co. at Smelt Hill, Bath, Maine, has been started up for the first time. This plant was built some six years ago, when the dam at the lower falls of the Presumpscot was constructed. The plant is arranged for 12 large turbine wheels. It has lain idle all this time, but recently the company acquired the right of way on the bank of the Presumpscot to Westbrook and has run a line of heavy copper wires whereon to convey the power from the new plant to the big paper mills. The distance is some five or six miles. The reason that this power has at last been transferred up the river and put into use is because of the lack of water at times to furnish a sufficient power at the paper mills.

## TRADE NEWS.

American enterprise and superiority of workmanship have received flattering recognition in the order for 26 trolley cars received by the J. G. Brill company from Cape Town, Africa, recently.

The Hunterdon Electric company of Lambertville, N. J., has recently purchased a 100 horse power Ball engine from the Parker Engineering company, Philadelphia, representative of the Ball Engine company, Erie, Pa.

General Manager W. C. Ballda, of the Utica Electrical Manufacturing company of Utica, N. Y., reports the largest trade in several years for his electrical specialties. The company has recently made improvements to meet the demand for its goods, and is expecting an unusually prosperous year. The demand for iron-clad fuse boxes is very large, and letters testifying to their excellence have been received from many of the large electric concerns of the country.

The Ohio Electric Works of Cleveland, O., are attracting attention with a novelty consisting of a low-priced but efficient electric light scarf-pin for gentlemen's wear. The device consists of a small incandescent lamp connected by fine wire with a pocket battery and a push button, which enables the wearer to illuminate the lamp at will, producing a brilliant effect. The outfit is durable, and will last for years, and its low price has made it popular among young men who care to adorn their persons with something novel. These scarf pin lights can be obtained in any color or clear crystal, also in opal, which appears like a "ball of fire," and gives perhaps the best effect. The catalogue of the Ohio Electric Works may be obtained by simply sending the address.

The Stilwell-Bierce & Smith-Vaile company has taken the contract for the complete water power plant to be installed at the Lachine rapids in the St Lawrence river. This power is second only to Niagara Falls in importance and is owned by the Lachine Rapids Hydraulic & Land company, Montreal. This power is located at the famous Lachine rapids on the St Lawrence river, so well known to tourists, about five miles above Montreal. The initial development will amount to 10,000 horse power. The work of construction has already been begun, and the company expects to be prepared to furnish power before the close of this year. It has contracted with the Stilwell-Bierce & Smith-Vaile company of Dayton, Ohio, for 66 large size Victor turbines of the latest pattern and all the connecting machinery needed for transmitting the power of these turbines to the electric generators. This is probably the largest order for turbines ever placed at one time, and will certainly add to the enviable reputation already enjoyed by the Victor turbine.

## BUSINESS.

The new spring catalogue of the Chicago General Fixture company will be ready for distribution on April 1st. Anyone desiring to obtain a complete catalogue of the latest fixtures can do so by dropping a postal card to the company.

The Electric Appliance company has been fortunate in securing some nice contracts for bare copper wire, acting as western selling agent for the Taunton Copper Manufacturing company. The product of this mill is well known as a particularly high grade article, and the Electric Appliance company hopes to make it one of its leading specialties.

It is an interesting fact that the "Few Buildings" illustrated by the Simplex Electrical company contain about 700,000 miles of Simplex braided caoutchouc wire. The Masonic Temple, Chicago, has about 350,000 feet of No. 14 Simplex braided caoutchouc wire, with a total of about 15,000 pounds of bare copper of all sizes. The City Hall, Milwaukee, has about 100,000 feet of duplex wire, and about 8,000 pounds of bare copper, all sizes. Ellicott Square building, Buffalo, has 150,000 feet of No. 14 duplex and about 11,000 pounds of bare copper all sizes.

The Garlock Packing company, sole manufacturer of the Garlock packings, with main offices at Palmyra, N. Y., and Rome, N. Y., Ga., and branch offices in the cities of New York, Boston, Chicago, Philadelphia, Pittsburg, St. Louis and Omaha, reports a large increase of business during the last few months, necessitating running its factories overtime. On account of the continued increase of the demand for the Garlock packings, the company is erecting a large addition to its factory buildings at Palmyra, N. Y.

The *Palladium* of Oswego, N. Y., in a recent issue, says: "Manager Hart of the street car company to-day entered into a contract with J. H. Felthousen, representing the Trump Manufacturing company of Springfield, Ohio, for two of the celebrated Trump model turbine water wheels. They are for the new power house to be built on the site of the old Skenandoah mills, and will develop 642 horse power on a horizontal shaft. They are said to be the best in the market and are to be delivered by May 1st."

It is confidently claimed that ordinary engine oil and Dixon's graphite will accomplish what the finest valve oil has failed to do, and hundreds of engineers are confident their engines are doing easier and better work and saving oil and fuel through the use of Dixon's pure flake graphite. Samples and testimonials and all information will be furnished by the Joseph Dixon Crucible company, Jersey City, N. J., which is the only manufacturer of a pure flake graphite, it being a product of the famous Ticonderoga mines owned by the Dixon company.

The many friends of C. O. Baker throughout the West will be interested in learning that he has recently accepted the position of manager of the western office of the Anchor Electric company of Boston, Mass. Mr. Baker has suite 1654-56 Monadnock block, Chicago, and will operate from this location as a center. Mr. Baker's management of the western branch of the Anchor Electric company will without doubt find a rapidly increasing western business. Mr. Baker has for over four years been identified with the Chicago General Fixture company of Chicago, and is a thoroughly excellent salesman with a host of friends who will undoubtedly do not a little toward helping him to a continuance of an already successful career. In identifying himself with the Anchor company, Mr. Baker made a wise selection, as his motto has always been "the best goods at fair prices."

The West End Street Railway company of Boston, Mass., using engines of various makes aggregating 20,000 horse power, has contracted with the Rice & Sargent Engine company of Providence, R. I., for two cross-compound engines, to be direct-connected to elec-

tric generators. These engines were selected in competition with the leading engine builders of the country, and their general dimensions are as follows: Indicated horse power, each engine, 1,500; diameter of high pressure cylinders, 26 inches; diameter of low pressure cylinders, 50 inches; length of stroke, 60 inches; number of revolutions per minute, 80; steam pressure per square inch, 150 pounds; diameter of flywheels, 24 feet; weight of each flywheel, 120,000, pounds, diameter of shafts in wheels, 24 inches; diameter and length of main bearings, 22 inches by 38 inches. The rims of the flywheels will be composed of forged steel, according to a new design, originating with the Rice & Sargent Engine company, and the wheels will be practically indestructible. Jet condensers and air pumps, driven by independent engines, will be used. Reheating receivers will be placed between the cylinders, and the piping will be arranged so that either cylinder of either engine may be run alone if desired. The design is an unusually massive one, even for street railway work, which is responsible for much of the increase in weight of modern engines. Although incorporated less than two years ago, the Rice & Sargent Engine company numbers among its customers many of the most conservative and influential corporations of the country, and the above contract is an indication of the reputation attained by its engines during this period.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued March 10, 1896.*

555,937. Conduit Railway System. Oscar A. Enholm, New York, N. Y. Application filed June 15, 1895.

The yokes have transverse arms adapted to receive the rails, and laterally arranged plates in line with the conduit openings through the yokes, the plates being broad U-shaped in cross-section, and having their ends adapted to fit together, the transverse arms of the yokes being arranged substantially midway between the opposite ends of the laterally arranged plates.

555,938. Individual Call System for Autographic Telegraphs. Harry Etheridge, Pittsburg, Pa. Application filed February 1, 1892.

The transmitter is provided with a stylus having three insulated contacts, one of which is connected to ground, the remaining two to transmitter resistances and to the automatic circuit-closing mechanism. There are also three contacts, one connected to the automatic circuit-closing mechanism, the remaining two to the same and also to the receiver magnets and transmitter resistances, the automatic circuit-closing mechanism, the switch-opening mechanism, and necessary electrical connections.

555,959. Underground Trolley. Myron D. Law, Washington, D. C. Application filed May 9, 1895.

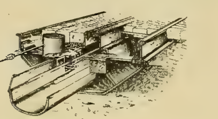
The inventor claims a trolley device, comprising a trolley leg provided at its lower end with an insulating base, a horizontal supporting arm consisting of a leaf-spring secured to the base, an upright trolley arm pivotally supported upon the supporting arm, springs tending to maintain the trolley arm in vertical position, and means for adjusting the height of the trolley arm.

555,963. Dynamo-electric Machine. William M. Mordey, London, England. Application filed April 21, 1891

A stationary non-magnetic armature having an annular series of coils and two series of rotating magnetic poles at opposite sides of the armature coils.

555,968. Electric Gas Lighting Burner. James A. O'Neill and George A. O'Neill, Boston, Mass. Application filed November 16, 1895.

In an electric gas lighting burner a movable collar having a cam in combination with a spring and controlling piece are claimed.



NO 555,937.

555,979. Electric Elevator. Humphrey R. Smith, Chicago, Ill. Application filed March 23, 1895

One of the claims is for a sectional solenoid, a car, a hoisting cable therefor carrying a magnetic piece forming the core of the solenoid, and means for successively energizing the sections of the solenoid.

555,984. Selecting and Operating Telephone. Herbert L. Webb, New York, N. Y. Application filed March 18, 1893

In a selective telephone system a single line on which is placed a telephone, and a single line on which are placed an impulse transmitting instrument and a selecting instrument at each of the stations, means operated by each of the selectors in response to impulses from any one of the transmitting instruments over the selector line, to thereby bring into circuit and connect the communicating telephones with each other

555,992. Electric Meter Charles Wirt, Philadelphia, Pa Application filed November 30, 1894

The combination is claimed of an electric motor for driving a register, the motor oscillating continuously when current is passing through the meter, and means controlled by a current indicator for controlling the arc of vibration of the motor, whereby the movement of the motor is made proportional to the current to be measured.

556,007. Automatic Telephone Exchange System. Moise Freudenberg, Paris, France Application filed January 10, 1896

Carriages are provided for connection with subscribers' lines, and there are switchboards or contact plates at the central station of less number than the number of subscribers, each switchboard having contacts for all of the subscribers' lines, devices such as brushes in electrical connection with the switchboards and with which the carriages are adapted to make contact to complete the circuit to the switchboard

556,027 Secondary Battery Plate Izak Samuels New York, N Y Application filed September 10, 1894

[illegible] secondary battery, comprising a positive electrode and a negative electrode, each having an equivalent amount of material, and the negative element being in two equal parts, arranged on opposite sides of the positive electrode, each electrode being composed of alternate plain and corrugated strips, and having heavier strips at top and bottom, the top strips forming terminals, and the strips being [illegible] the same material

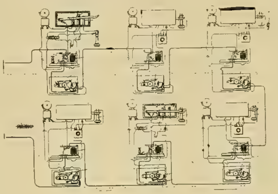
556,0[illegible] Circuit Block. Dany A Schutt Peru Ind. Application filed November 16, 1895

The device is intended for use in making branch electrical connections and consists of two or more sections [illegible]

insulating material secured together by one or more metallic connections attached to each section, such metallic connections having electrical connection with main feed and branch wires respectively.

556,034. Telephone Speaking Tube System. John S. Stone, Boston, and George K. Thompson, Malden, Mass. Application filed September 28, 1895.

Special features of this invention include a polarized call-bell, consisting of a hollow metal casing open at both ends, with a bar across one end, a permanent magnet inclosed in the casing and secured by one pole to the bar, an electro-magnet within the casing between the poles of the permanent magnet and secured to the under side of the bar, having attached to its free end a pivoted armature and a circuit-breaker, the armature carrying a bell-hammer which extends through the casing into proximity with a gong secured thereto.



NO. 555,984.

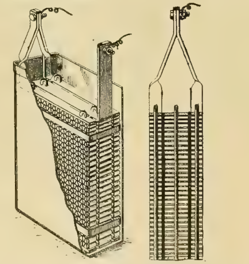
556,038. Electrolytic Apparatus. Michael H. Wilson, Brooklyn, N. Y. Application filed May 8, 1895.

An apparatus for electrolytic decomposition is illustrated, comprising a reservoir for the substance to be decomposed, and electrodes connected with external electrical conductors and serving as conducting media, through which the electric current enters or leaves the substance to be decomposed, the electrodes comprising a column or stream of water of relatively small diameter, and means are provided for supplying the water column.

556,046. Rail Bond for Electric Railways. Fred H. Daniels, Worcester, Mass. Application filed June 26, 1895.

The terminals have heads of cylindrical shape and are each provided with an opening to receive the end of the bond wire or rod, and the cylindrical hollow portion is adapted to extend through a hole in the rail, and to receive a drift pin or taper-tool, a bond wire or rod is made separate from the terminals.

556,072. Electric Signaling System for Railways. George L. Thomas, Brooklyn, N. Y. Application filed June 11, 1895.



NO 556,027

A track section having its rails insulated from adjacent track sections, the adjacent track sections each having rails in an electric circuit with a relay, the one with a relay at a signal tower at one end of the intermediate track section, and the other with a relay at a signal tower at the opposite end of the intermediate track section, a signal-controlling electro-magnet at each of the towers, and electric circuits including the rails of the intermediate track section, the armatures of the relays and a second relay at each of the towers for permitting or preventing the operation of the signals at the towers, according to the position or positions of a train or trains on the track sections.

556,079. Electric Car Lighting System. Albert H. Armstrong, Schenectady, N. Y. Application filed May 31, 1895

The invention comprises a three phase railway line, electrically propelled vehicles thereon, one of such vehicles making traveling contact with the supply lines, a step down transformer carried upon one of the vehicles, a motor generator carried upon the vehicle and supplied with current from the transformer, lamps supplied from the continuous current side of the motor-generator, storage batteries included in circuit with the lamps, and means in the alternating current circuit for automatically cutting out the motor-generator and lighting the lamps from the storage batteries upon cessation of the alternating current.

556,138. Electric Gas Igniter. James P. Doyle, Buffalo, N. Y. Application filed October 29, 1895.

In an electric gas igniting burner having a fixed electrode and a movable electrode actuated by the valve stem, the combination is claimed with the movable electrode of a hinged and slotted gravity cam, by means of which the movable electrode is vertically actuated to effect a contact of the electrodes in one direction only.

556,176. Brush for Dynamo-electric Machines. Frederick J. Chaplin and Robert Chaplin, Birmingham, England. Application filed December 10, 1895.

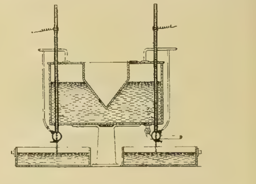
The improvement consists of longitudinal wires crimped and grouped together into the required section.

556,183. Electrically Operated Railway Gate. Benedikt Haberthur, Logansport, Ind. Application filed October 15, 1894.

A gate beam is normally held in a raised position, and a spring-pressed arm engages with the end of the beam and locks the gate in its raised position. Electrically controlled means are provided for withdrawing the spring pressed arm, so as to permit the fall of the gate, and a track instrument is mechanically connected with the gate operating mechanism for raising the gate when depressed by the passage of a train.

556,189. Electric Gas Lighting Device. John B. Jackson, Philadelphia, Pa. Application filed August 15, 1895.

This is a burner with a cock having a radial arm thereon, an elbow lever having one of its limbs pivoted to the arm, and provided with a slot at its angle, the axial pin of the lever working in the slot, and an electrode carried by the other limb of the lever, the parts being combined.



NO 556,038

556,210. Electric Railway. Harry C. Reagan, Jr., Philadelphia, Pa. Application filed September 6, 1895.

The inventor claims the combination with a cable grip having an electro magnet and contact devices mounted thereon, of a feed wire, a suitable conduit therefor, and contacts rotatably mounted on the feed wire, the latter forming an axis for the contacts.

556,311. Closed Conduit Electric Railway. Ernest R. Esmond, New York, N. Y. Application filed October 18, 1893.

The trolley rail or conductor section is arranged to form part of the motor circuit, the electro-magnet or solenoid having its coils included in the circuit, contacts in the motor circuit being controlled by the armature or core of the magnet or solenoid, and a counter-balance weight and system of leverage for the armature or core.

556,315. Electric Snow Plow. Henry H. Kryger, Minneapolis, Minn. Application filed September 10, 1891.

The first claim follows. The combination with a suitable car, of a frame supported upon the end of the car, a transverse endless carrier mounted upon the frame and provided with a series of open cutters, and with a series of carrying plates and an electric motor connected with the carrier and adapted to drive the same.

556,320. Electric Railway. Eben M. Boynton, West Newbury, Mass. Application filed March 6, 1895

A single rail supported railroad car with a railroad structure having one supporting rail, conducting and guiding devices, and an induction motor placed in the car and supplied with a multiphase current from the conducting devices.

556,321. Electric Underground Trolley Railroad George D Burton, Boston, Mass Application filed December 21, 1895

One of the claims is for a casing for an electric conduit, comprising an inner and an outer shell, the inner shell being provided with a lining of non-conducting material, and a non conductive filling between the shells.

556,322 Electric Railway. Rudolph M Hunter, Philadelphia, Pa. Application filed July 19, 1886.

A slotted conduit containing working conductors is claimed, together with a traveling electric motor or vehicle, a laterally movable frame suspended from the vehicle over the slot, and a cleaning brush pivoted thereto on a vertical axis.

Western Electrician.

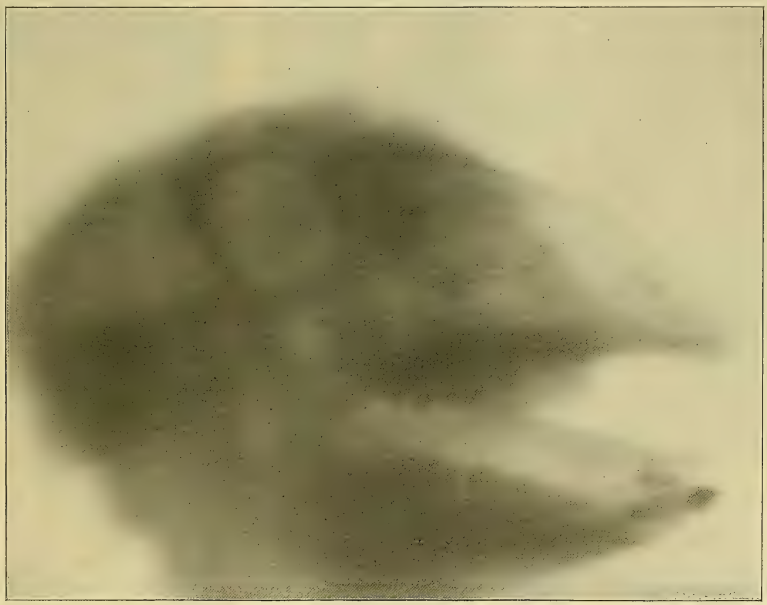
EVERY SATURDAY.

Vol. XVIII. CHICAGO, MARCH 28, 1896. No. 13

## Sciagraph of Sheep's Brain.

Experimenters with X-rays have resorted to all sorts of devices and novel ideas in conducting their investigations and presenting the results of their researches, in order to attract attention to their work, and this has at least had the effect of somewhat relieving the monotony of the study of hands, which for a time absorbed the community. The latest claimant for public consideration is John Kammer of Chicago, who claims to have conducted his experiments along original lines, and he presents as a specimen of his production a sciagraph of a sheep's brain, which is herewith reproduced. Mr. Kammer's work has been confined principally to the development of tubes that may be used in place of the Crookes tube for X-ray experiments. He is an expert incandescent lamp maker, and his experience led him to believe that good working tubes could be constructed from American glass. His experiments, thus far, have confirmed this opinion, and while he is not yet prepared to divulge the details of his work and the results of his tests, he claims to have reached the point where he can make the announcement without any hesitation whatever that American glass is far superior to the German article, as the tubes constructed by him, he says, have worked to better advantage than the best Crookes tubes. As evidence of the superiority of his methods and apparatus the picture on this page is interesting. It is certainly an excellent production, and when it is considered that it is the first successful experiment of the kind thus far recorded, it is not surprising that Mr. Kammer is elated over the result of his work.

Other experiments conducted by him at his laboratory in the Sunbeam Incandescent Lamp Works lead him to believe that the X-ray will be of incalculable value in surgery, medicine and chemistry. Cavities in bones or in other parts of the body, and the substances present in these cavities, offer an almost inexhaustible field of investigation and one which may be productive of results of great consequence to medical and surgical science. The variations in the intensity of the shadow are, he claims, to some extent an indication of the character of the substance, and he hopes by the perfection of the details of investigation, by graduation of the strength of the X-rays employed, by adjustment of the distance of the focal point from the object, and the evolution of a set of rules governing the period of exposure, to make these shadowy indications more and more intelligible to the expert investigator. As a means to this end he has now entered upon a series of experiments with glasses containing liquids of different kinds so grouped together that the discriminative power of the X-ray in sciagraphing each shall be displayed for comparison. Among these liquids animal secretions will be the most important section, and he hopes by this process to assist also the diagnosis of solid matter formed within the body. Sciagraphs of plaster of paris molds of different thicknesses, with the contrasted shadows of metallic objects within and beside them, have a bearing on the study of the variations of intensity of shadow, and have also another and well defined purpose to aid surgical science in the treatment of fractured bones when plaster of paris has been used in the setting and it is desired to note the progress toward recovery. From his observations Mr. Kammer believes that X-rays will be found to exercise important functions in chemical experiments, rendering feasible, in certain circumstances, operations which otherwise are liable to fail in consequence of the presence of disturbing elements.



SCIAGRAPH OF SHEEP'S BRAIN

## Röntgen Rays Anodic, Not Cathodic.

By Elihu Thomson.

Since the first publications concerning Röntgen's discovery of the rays emanating from a Crookes tube it seems to have been assumed by most investigators that these rays have some relation to the radiant matter of Crookes, which is a phenomenon of the cathodic terminal.

Others, again, have considered that the rays discovered by Röntgen were produced at the glass surface or during transmission through the glass, and as a consequence of the impingement of the cathode rays upon the glass, causing its fluorescence. Prof. J. J. Thomson is reported to have exposed photographic plates to the cathode rays or radiant matter within the tube without having produced any effect which could be brought out by development.

Very recently Prof. H. A. Rowland has pointed out the fact that the Röntgen rays are emitted from the anode and not from the cathode, and this view, coming from so high an authority, is in itself an indication of its probable truth. The writer, personally, had been led to suspect that the rays were anodic, not cathodic, for it was found that the rays, when traced to their source within the tube by methods which have been published by him, came from that terminal which during the passage of the spark discharges could not have been the

cathode. Using a Wimshurst machine it was easy to determine the polarities. Furthermore, the best effects on the photographic plates were produced opposite that portion of the glass which became strongly fluorescent. This fluorescence, however, could not have been produced from the cathode, as the rays normal to the cathode surface would not have impinged there.

By constructing a dark tube with a screen of barium platino-cyanide, the writer was able to submit to examination the various forms of Crookes tubes in his possession. Some of these, though fluorescing strongly by the cathode rays, gave at no position with respect to the screen tube any indications of the emission of Röntgen rays, while some gave feeble indications near the anode, and in exceptional instances a strong effect was noted, not from those parts where the cathode rays made the glass fluorescent, but from other parts opposite the anode.

The crucial test was made by placing a small patch of opaque metal upon the side of the tube opposite the anode. It was found that when the anode, the patch and the fluorescent screen were in line, no fluorescence was obtained, although the screen was fully exposed, as it were, to the cathode.

It may be mentioned here that the fluorescent screen tube forms a most valuable means for rapidly exploring the field of the Crookes tube and so determining whether it can be used as a source of Röntgen rays or not. It also enables one to determine the best direction in which the rays are emitted and is much quicker than the sensitive plate for such observations.

In one of the tubes examined the effects appeared to indicate that the Röntgen or anode rays are deflected or turned aside sharply when they arrive near the cathode terminal, which in this case was a bent sheet of aluminum. This effect is worthy of further investigation.

The writer also personally exhausted a Crookes tube by a Sprengel pump, watching with a fluorescent screen tube for the first indications of Röntgen rays. It was found that when that degree of exhaustion was reached which gave an excellent exhibition of radiant matter from the cathode, and even clear-cut shadows of objects by such rays, as evidenced by the brilliant fluorescence of the glass where the rays impinged, there still was no indication of Röntgen rays, even when the fluorescent screen in its dark tube was not more than a quarter of an inch from the strongly fluorescing glass wall. As, however, the exhaustion improved, the indications of Röntgen rays began to be manifest, and at last they became quite pronounced. These rays seemed to originate at the anode, and although they may possibly be deflected in the vicinity of the cathode, they otherwise proceed in straight lines from the anode and through the glass, causing fluorescence of the latter in much the same way to all appearances as the cathode rays, except that while the Crookes tube; cathode rays (radiant matter) apparently do not.

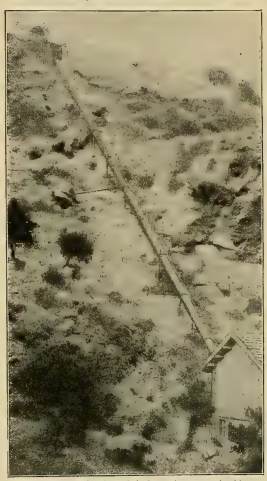
Fourth—Both anode and cathode rays cause fluorescence of the glass and possibly of many other substances.

It is not known whether anode rays cause fluorescence of any substances that are not so affected by the cathode rays, and vice versa.

Fifth—Anode rays are erratic in distribution from the anode surface. Cathode rays are of nearly uniform distribution, and leave the cathode surface at right angles.

Sixth—Anode rays are not capable of being deflected by a magnet, at least not after they have passed the glass. Cathode rays appear to be so deflected within the tube and after they have traversed an aluminum window. (Lenard.)

Seventh—Diminishing the size of the anode concentrates and focalizes the rays emanating therefrom. Sharpened and the scientific interest therein multiplied when it is recognized that there may be an entirely unsuspected radiation, not from the cathode but from the anode; that both electrodes may emit radiations characteristic of the electric states of the terminals, and that such radiations are widely different from each other and from other known radiations. If the anode rays are longitudinal waves in the ether, what are the cathode rays? If the cathode rays are longitudinal, what are those of the anode? Is it possible that neither of them are longitudinal vibrations of the ether and that one must now look for an explanation of the two radiations which shall be alike, and yet not alike?



Water Power. Steel conduit down the mountain side.

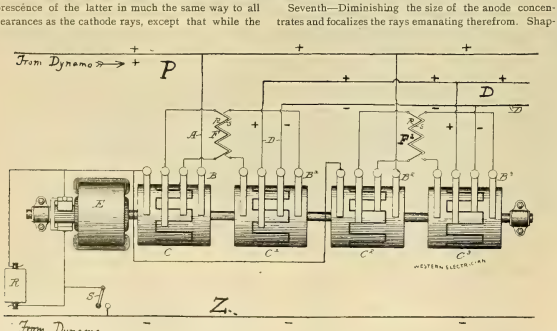
Exciter and Transformer.

FIGS. 1 AND 2. ELECTRICITY IN ALGERIA.

In these radiations there may be again a manifestation of differences between positive and negative electrical states, which differences seem to be in some way impressed on the radiations set up in the neighborhood of the poles. There undoubtedly is a great field for research opened by the discovery of Röntgen, and it is fortunate for science that the Crookes tube he experimented with possessed a high enough vacuum to cause it to give anodic as well as cathodic rays.

## Continuous Secondary Currents.

A recently patented method of obtaining secondary currents of continuous direction and uniform strength at a distance from a main direct current generator is herewith illustrated. This transformation is accomplished by means of ordinary converters whose primary coils, with associated pole-changing commutators or current reversers, are connected between main leads carrying a continuous current. The pole changers cause the current to pass through the primary coils alternately in opposite directions, and the resulting alternating currents in the secondary coils are commutated before reaching the working circuit by pole changers operating synchronously with the pole changers that reverse the connections of the primary coils. Each transformer requires two pole changers, one each for the primary and secondary coils. Two or more transformers and their accompanying pole changers are used for each transformed circuit, the pole changers for each transformer reversing at a time different from that at which the pole changers of any other transformer reverse, the effect of this being to make the transformed working current, to which the secondary coils contribute, more uniform in character than if supplied by only one secondary.




CONTINUOUS SECONDARY CURRENTS.

Referring to the diagram, the motor $E$, of small power, revolves the shaft and the various pole changers, insulated from each other, which are mounted on it. By varying the shunt resistance $R$, the current through the motor may be increased or diminished. $C$ and $C^1$ are pole changers for transformer $F$. $P$ is one of the main leads. The main current passes from it by $A$ and the fourth ($B$)

cathode ray fluorescence is fairly stable or stationary, the anode-ray fluorescence flits about or changes its direction with every discharge, scarcely if ever repeating the same pattern of fluorescent patches on the walls of the tube or bulb.

The following summary of effects is apparently in accord with the facts:

First—Cathode rays are produced at lower exhaustions than give rise to anode rays that reach the glass.

Second—Anode rays are best produced at the very highest exhaustion short of insulation.

Third—Anode rays pass out through the glass of the tube; cathode rays (radiant matter) apparently do not.

Fourth—Both anode and cathode rays cause fluorescence of the glass and possibly of many other substances.

It is not known whether anode rays cause fluorescence of any substances that are not so affected by the cathode rays, and vice versa.

Fifth—Anode rays are erratic in distribution from the anode surface. Cathode rays are of nearly uniform distribution, and leave the cathode surface at right angles.

Sixth—Anode rays are not capable of being deflected by a magnet, at least not after they have passed the glass. Cathode rays appear to be so deflected within the tube and after they have traversed an aluminum window. (Lenard.)

Seventh—Diminishing the size of the anode concentrates and focalizes the rays emanating therefrom. Sharpening the cathode into a concave cup gives rise to a focus of cathode rays by virtue of their direction being normal to the cathode surface.

The question suggests itself, Can anode rays reach and pass through a thin aluminum sheet which is at the same moment the cathode for the discharge? And, on the other hand, Can cathode rays traverse the anode if of thin aluminum sheet? It is probable that opacity of the opposite terminal would be noted in these cases, and possibly deflection of the rays in each case near the terminal of opposite polarity to that emitting the rays.

The significance of Röntgen's discovery is greatly enhanced and the scientific interest therein multiplied when it is recognized that there may be an entirely unsuspected radiation, not from the cathode but from the anode; that both electrodes may emit radiations characteristic of the electric states of the terminals, and that such radiations are widely different from each other and from other known radiations. If the anode rays are longitudinal waves in the ether, what are the cathode rays? If the cathode rays are longitudinal, what are those of the

and second brushes of $C$ to the upper binding post of the primary coil of transformer $F$, then through it downward (graphically), thence via the third and first brushes to the switch $N$ through motor $B$ and its shunt resistance $R$; from the switch (when closed) to the other main lead $Z$. The induced current in the secondary of $F$ passes upward (graphically) to the fourth brush ($B^2$) of $C^1$, thence through second brush to the upper or plus wire of working circuit $D$, returning (after operating translating devices not shown) to the secondary coil via third and first brushes.

Assuming that the pole changers have revolved a distance equal to the width of one segment beyond their position as shown in the illustration, it will be found on now tracing the path of the current that it passes through transformer $F$ primary (graphically) upward, reversing its former direction, and a corresponding change has taken place in the secondary coil; nevertheless, on account of the change in position of the inside brushes of $C^1$, the transformed current is delivered to the working circuit in the same direction as before, so that no matter how the current passes through the transformer coils, it always is delivered to the working circuit in a continuous direction. When the inside brushes of $C^1$ are resting on the insulation between the segments, there is momentarily no current whatever delivered from the secondary of $F$. To prevent such interruption to the working circuit, an additional transformer $F^1$ and set of pole changers $C^2$ $C^3$ are shown, connected in multiple with the first set. The inside brushes of $C^2$ $C^3$ are placed the distance of one-half segment different from the brushes of $C$ $C^1$, so that when they rest on the insulation (as shown) the working circuit is supplied from the secondary of $F$, and vice versa. When three sets of transformers and pole changers are used (to obtain still greater uniformity in the working circuit), the inside brushes of each set are positioned one-third of a segment apart.

The continuous current in the secondary circuits may be be used to operate motors, for electric lighting and plating, telegraphy, and for any other purpose for which continuous current is suitable. It will be seen, also, that alternating currents may be obtained from the terminals of either the primary or secondary converter coils. The circumference of the pole-changing commutators may be increased, so that the number of alternations in the transformers may be augmented without increasing the speed of their revolution.

A patent for this direct current transformer was lately allowed to Chas. M. Davis of Chicago.

## Salvioni's Cryptoscope.

There has been considerable interest manifested in Professor Salvioni's method of enabling one to see through solids, much the same as through a photographic camera. This discovery was referred to in the WESTERN ELECTRICIAN of March 7th. Further particulars are noted in Professor Salvioni's paper on the subject, of which the following abstract is from a translation in *Nature* of the proceedings of the Academia Medico-Cherurgica di Perugia.

Though the retina may be fluorescent to the Röntgen rays, as is the glass of the photographic plate, it is hardly probable that it could see objects directly through layers of wood, aluminum, flesh, etc. This, however, does not exclude the possibility of seeing them indirectly, by transforming, so to say, the Röntgen rays into ordinary luminous rays before they reach the eye. I have made a simple arrangement by means of which I can distinctly see the shapes of bodies enclosed in boxes of cardboard, aluminum, etc. This cryptoscope, which I have the honor of showing to the academy, consists of a small cardboard tube about eight centimeters high. One end is closed by a sheet of black paper, on which is spread a layer of fish glue and calcium sulphide (there being no barium and platinum cyanide at hand); this substance I have found to be very phosphorescent under the action of Röntgen rays. Within the cardboard tube, at the other end, at which the eye is placed, is fixed a lens, giving a clear image of the phosphorescent paper. On looking through this cryptoscope one can see, even in a light room, the shape and position of metallic bodies enclosed in boxes of cardboard, wood, aluminum, and within the flesh. Its action is obvious; the fluorescent paper, under the action of the rays, is illuminated only in those portions which receive rays, consequently the silhouettes of the objects intercepting the rays appear dark. In this there is, of course, nothing new which could not have been deduced from the original experiments of Röntgen; the novelty, if indeed it is so, consists merely in making use of the known facts to design the arrangement.

It seems to me that, in a more perfected form, it might be of extensive use in surgical and medical science. The sulphide of calcium may be replaced with advantage by the cyanide of barium and platinum. It is further clear that when, by a camera or other means, not only the shadows, but also the images, can be photographed (which, I believe, Profs. Battelli and Garbasso of Fisa have already succeeded in doing), the same cryptoscope will render visible also the images of bodies enclosed in wood or other materials.

## Edison's Latest Announcement.

According to a New York publication Mr. Edison has succeeded in penetrating the human body with the naked eye. He looked into the heart and lungs, and examined the arteries, the blood vessels and muscles of one of his assistants. The same paper is authority for these details.

Mr. Edison is now completing a fluorescent screen eight feet high, which will enable him to see the entire body from the top of one's head to the sole of one's feet. The fluorescent substance used by Mr. Edison is tungstate of calcium. The substances are fused in a furnace and at a proper degree of heat form little crystals perhaps one-eighth the size of a French pea. These crystals are glued to a piece of paper by means of collodion, a transparent celluloid paint. In the case of the huge screen that Mr. Edison is building for taking at a glance the entire internal organism of a man the crystals would be spread directly on an inch plank. The screen is made in the shape of a monster mill hopper, standing on end. The face on which the crystals are applied is about eight feet high and four feet broad. To this face will be fastened sides that will slant inward to a sharp point. At this point there will be left a slit just large enough to see through with ease. This slit will be protected by means of a rubber flap in such a way as to exclude all light when the eye is applied to it. The screen will be set up so that the side on which the tungstate of calcium has been glued faces a row of four or five Crookes tubes, set one above the other, at an equal distance. The person to be examined will then step in between the screen and the light, and he will be instantly penetrated and become visible to the eyes of the examiner at the screen.

## Röntgen Rays From Incandescent Lamp Bulbs.

Prof. Joseph F. Smith, of the Northern Indiana Normal School at Valparaiso, Ind., is continuing his experiments with incandescent lamp bulbs as substitutes for Crookes tubes in producing the X-rays, following the plan outlined in this journal on March 14th. Under date of March 23d he sends two sciagraphs to the WESTERN ELECTRICIAN, taken by this process, which show an advance on the one presented in the previous issue of this journal. Prof. Smith says:

I have extended somewhat my experiments with lamp bulbs and have been able to get results from several. I find, however, that the matter of potential seems all important. With a half-inch spark I have not been able to get sciagraphs with any length of exposure. It seems that a two or three-inch spark at least must be used. I have also found that redevelopment seems to greatly improve the sharpness of the sciagraph.

## Electricity in Algeria.

At an altitude of 820 meters, backed up against the peak of a steep mountain in the province of Oran, Algeria, is the little town of Tlemcen, once boasting a population of 100,000, but now rated at 27,000, of whom 5,000 are Jews, 16,000 are Mussulmans and 6,000 are Europeans, largely French.

Tlemcen is one of the most important towns in Algeria, and one of the most picturesque as well. The white minarets, like emblems of peace, are everywhere in view; the streets, bordered by majestic trees, olive and fig and mastic, vie with each other to beautify and adorn the landscape, while its sloping position presents a perspective of magnificent beauty.

After several vain attempts, it was finally the good fortune of a French engineer to secure a franchise for

FIG. 3. ELECTRICITY IN ALGERIA.—AERIAL LINES.

an electrical equipment for the city, included in which was an excellent hydraulic power freely furnished by the cascades of Meffrouch, on the Saf-Saf river, at an altitude of 1,012 meters. This water power was brought to a mill about six kilometers from Tlemcen by air line, and here the dynamos and auxiliaries were installed. A dam was placed across the Saf-Saf, and a raceway brought the water to a point 66 meters above the station into a reservoir. From this point a steel pipe 70 centimeters in diameter (Fig. 1) leads to the turbine. This tube is so arranged as to permit of contraction and expansion, and is supported in such a manner that it may be moved without injury. The lower end of the tube terminates in the wheel house, where there are two tubes of the same diameter cemented in a conduit carried beneath the floor of the station. Here are two turbines of 75 horse power each, with a discharge of 150 liters of water per second. Two alternators are run by these turbines, operating at 360 revolutions and developing 25 amperes at 2,400 volts. The connection between alternator and turbine is through rubber ring cushions, which so completely modifies the shocks as not to perceptibly affect the regularity of the machines or the light. The exciter (Fig. 2) of each of these generators is run separately, and in its turn furnishes current for pilot lamps on the machines. The dynamos are readily coupled in parallel, and the switchboard is a model of simplicity.

From the station the lines, four in number, are aerial (Fig. 3) and upon the same poles are seen two other conductors for telephonic purposes. The former are 5.5 millimeters diameter, and bare stranded copper is used until the outer wall of the city is reached; from that point the conductors are heavily insulated. The posts are 10 meters in height.

The place has been divided into seven sectors or districts, the central point of distribution being at the Mairie or mayor's headquarters. These are grouped into three principal quarters, as follows: First, the Mairie, which is in the midst of the central quarter, is mostly inhabited by Jews, and includes one of the most popular promenades of the place (Fig. 4); second, the old Arabian quarter (Fig. 5), with its curious original streets, narrow, tortuous and often tunnelled; the mosques, the low dwellings and little shops—first to adopt and endorse the innovation; one of these grand mosquès presents an interior shown in Fig. 6; third, the quarter which includes the Mèchouar, the ancient citadel, the military quarters, hospitals, prison, etc., all of which are now illuminated by electricity.

An excellent idea of the form of line construction and the picturesque character of the places invaded can be gained from these illustrations. There are other features about this installation that will interest the modern engineer. At the Mairie a huge sentry-box sort of affair stands guard over an 18 kilowatt transformer, and at other points scattered throughout the city are more transformers of 58 kilowatts capacity. The combinations capable of being worked at the distribution points are such that if a dynamo, A for instance, is feeding transformers 1, 2, 3, 4, and B is feeding 5, 6, 7, the current of A can be switched to 7 and that of B on 2, and so of all other combinations.

The principal consumers of this quarter are found in cafés, hotels and the theater. The tariff of lighting shows how differently the scale of illumination is arranged from our own:

I. Establishments habitually open till midnight, per annum:

| For one lamp. | 5 c. p. | 10 c. p. | 16 c. p. |
|---|---|---|---|
| Until midnight..... | *f.* 36 | 45 | 54 |
| Until and after midnight... | *f.* 42 | 54 | 66 |

II. Establishments and apartments habitually open until 10 P. M., and occasionally to midnight:

| For one lamp. | 5 c. p. | 10 c. p. | 16 c. p. |
|---|---|---|---|
| For the evening..... | *f.* 24 | 36 | 45 |
| Till after midnight.... | *f.* 42 | 54 | 66 |

Lamps of five candle power are only furnished for passages, closets and the outside lanterns of Moorish cafés.

Each lamp installed is charged for at 15 francs, which includes lamp, socket, cut-out, wire, cord, labor, etc. Lamps burned out or broken are replaced for two francs each.

The municipal contract proper calls for 200 lamps of 16 candle power and 100 lamps of 10 candle power, which give an average illumination of nine hours per night. For this the city pays 17,000 francs per annum, and an excess of 50 francs each for 16 candle power lamps in addition to this number and 30 francs for additional lamps of 10 candle power.

Lights in municipal buildings, in the theater, lyceum, Mairie and other public offices are entitled to a rebate of 20 per cent. over those of individuals.

The Arab population is especially enamored of the electric light, which knows neither chimney nor wick, demands neither filling nor trimming, and lights without a match.

The illustrations are reproduced from *L'Energie Electrique*

## Electrical Equipment of the Lake Street "L" Road.

The third rail for the operation of the Lake Street "L," Chicago, by electricity has been laid from State street to California avenue, and the work of putting it in place from California avenue is now in progress. The feeder wires have been strung from the power house of the West Chicago Street Railroad company to the tracks at Western avenue, and from Western avenue to State street. This portion of the track is ready for operation. There are to be 30 motor cars, and of this number more than one-half are now ready for service. Twenty-six of the motor cars are smoking cars remodeled and four are other cars. No new cars were built for the road. Air brakes are now being put in place on all the cars, and in doing this three cars are taken off the line at one time and equipped and then returned to service. By May 1st at latest the intention is to begin operating the line with electricity.

## Liberal Business Paper Space.

By N. C. Fowler, Jr.

The way you say a thing is as important as what you say. You'll waste your milk if you try to put a gallon into a quart measure. You'll waste the good of advertising if you over-fill your space, or don't use space enough. If advertising is any good, and all good business men say it is, the good of it is in a good deal of it.

Half the business paper advertisements occupy half enough space. Folks are not obliged to read advertisements any more than they are to eat hash at a restaurant. The successful hash seller makes good hash, and serves it well. The successful advertiser has something to say, says it well and serves it well.

You must make people read your advertisements. That's your part of the business. If you don't use space enough for folks to see that you're advertising, you might just as well not advertise.

I don't own any trade paper. It doesn't make any difference to me whether you use much space or little space. I am only telling you what experience has proven to be the correct method of publicity.

When advertising pays, it is made to pay. Nothing will do anything unless made to do it. Your name and address, with what you do for a living, in the trade paper, may bring some return, but there is no particular reason why it should. The law of averages is safer to follow than the rule of exceptions. What you think individually may not be right. What the majority think stands some chance of being correct. The fact that nearly all successful advertisers use plenty of space indicates that plenty of space pays proportionately better than not enough space.

You have something to sell; it is your desire that somebody take it away from you at your price. That's what you're in business for. It's pretty hard to sell a dollar's worth of goods by using a cent's worth of telling space. I am of the opinion that nearly every advertiser of small space will make his advertising pay more than twice as well by doubling his space. Experience says so, and experience doesn't lie.

If folks don't see your advertisement, what's your advertisement good for? How do you expect them to see it, if it's so small you have to hunt for it yourself? Treat your advertising space as you do the sign on your building. Have it large enough for folks to know you're there.

Perhaps it will not pay you to use a full page, although the full page advertisers are the most prosperous. I don't think less than a quarter of a page is worth more than a quarter as much proportionately.

Of course the advertising solicitor wants you to increase your space. He wouldn't be much of a solicitor if he didn't. Because it pays him to have you increase your space is no reason why it shouldn't pay you.

Too much of a good thing isn't profitable; that is, if too much of a good thing is possible, but there's no business sense of having too little of a good thing.

When you economize, it isn't good business to tell everybody about it. Appearance of success means success. When you cut your advertising space you tell outsiders that something is the matter with the inside of your business. Liberal advertising space is a sign of prosperity.

FIG. 5 ELECTRICITY IN ALGERIA.—AN ARAB STREET.

## Electric Railway Mail Service.

The postoffice appropriation bill, as passed by the House of Representatives, carries with it an appropriation of $150,000 to be used for the transportation of mail by electric and cable systems. The postmaster-general is authorized to adjust the compensation to be paid for the transportation of mails on electric car and cable routes at the following rates:

For full railway postoffice cars, which are to be used

for postal purposes only, to be operated independently of other cars, and to be not less than 16 feet, inside measurement, the compensation shall not exceed 12 cents per mile traveled.

For compartment postoffice cars, to be operated independently of other cars, the compartment to be used for postal purposes to be not less than 10 feet in length, inside measurement, and full width of car, or not less than 24 feet in length and five feet in width, inside measurement, not to exceed seven cents per mile traveled.

For trailer postoffice cars, to be run with regular passenger cars, and to provide space for postal purposes not less than 10 feet in length, inside measurement, and full width of car, not to exceed five cents per mile traveled; or, if under 10 feet but not less than 12 feet in length, inside measurement and full width of car, not to exceed four cents per mile traveled.

The compensation will apply only to electric and cable routes not exceeding 20 miles in length; the rate of pay for carrying the mails on longer electric and cable car routes is to be as provided by existing law for the transportation of mails on steam railroad routes. It is further provided in the bill that all street railway companies carrying mails shall furnish free transportation to letter carriers to and from the postoffice and their respective routes if the distance exceeds one-half mile.

## Anti-Bell Telephone Association in Iowa.

The Iowa Telephone association held its first meeting in Des Moines on March 18th and 19th. The proceedings were conducted behind closed doors. A large amount of business was transacted, all relating to measures for the retention of the business of the independent telephone companies in the state and the defense of their common interests against the assaults of the Bell Telephone company. A schedule of rates for toll lines was adopted with the understanding that it should not be binding, but only suggestive as to what the association would generally consider fair charges, the schedule being as follows: Up to 20 miles, 20 cents; 20 to 25 miles, 25 cents; 50 to 100 miles, 35 cents; 100 to 150 miles, 40 cents; 200 miles, 50 cents; 250 miles, 60 cents; in excess of 250 miles and not out of the state, 75 cents.

A committee was appointed to act in the matter of litigation involving associated members. Another committee appointed is to submit information to the association as to prices of supplies. A third committee was empowered to incorporate the association.

The question of furnishing telephones free to railroads or others was decided in the negative, the sense of the meeting being unanimous against "dead-head" telephones.

A resolution was passed pledging the support of the association to an independent movement to establish an exchange in Des Moines.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Luce-Vietch Telephone company of Galesville, Wis., will extend its lines to Ettrick in the spring.

The Northwestern Telephone Exchange company will extend a line from Albert Lea, Minn., to Wells, Winnebago City, Blue Earth City and other towns in that vicinity this season.

It is probable that the Western Electric Telephone company will connect its long-distance wire with Faribault, Minn., this season.

The Northwestern Telephone Exchange company is securing a right of way from St. Cloud, Minn., to Fargo, N. D., for its long-distance line.

The Spirit Lake Telephone company is an applicant for a telephone franchise at Worthington, Minn.

The Iowa Union Telephone company is arranging to extend a line from Allerton to Chariton, Ia., via Russell and Corydon.

Waterloo, Ia., parties propose a telephone exchange at Shell Rock, Ia.

H. E. Termath is organizing a company to build a line from Le Sueur, Minn., to Le Sueur Center.

The Grant County Telephone company of Bloomington, Wis., has been incorporated with $10,000 capital stock.

## Western Union Not Compelled to Admit Competitive Telephones.

An important decision was announced by Judge R. G Siebecker, of the Circuit Court, in Madison, Wis., on March 18th, in the case of the Dane County Telephone company against the Western Union Telegraph company, when he notified the attorneys that he had decided to deny the writ of mandamus asked by the telephone company to compel the Western Union to admit new telephones to its offices.

There is a widespread interest in the outcome of the contest, owing to the fact that the Western Union has a contract with the Bell Telephone company for reciprocity in business relations, and Manager B. B. Clarke, of the local telephone company, has had letters from managers of local exchanges in all sections of the country, from New York to California, asking to be kept posted on the result. The question involved is a new one, with no decision of other courts on the point at issue. There is

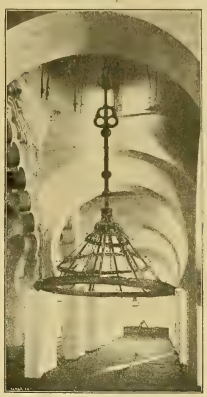


FIG. 6. ELECTRICITY IN ALGERIA.—INTERIOR OF MOSQUE, SHOWING ELECTROLIER.

no doubt the case will be taken to the Supreme Court for final decision.

Judge Siebecker, in his decision, says:

I have come to the conclusion that the application differs radically from the principles determined in cases cited wherein one common carrier has been compelled to offer the same rights and privileges to the public that it has granted by means of its relationship to another common carrier. To grant the application the court would have to say that the transmission of telephonic messages and the delivery thereof from the office of the telegraph company over the wires of a telephone company is a public right that can be enforced as such against the telegraph company by reason of its being a common carrier. I think that this principle cannot be applied, for the reason that a telegraph company may deliver its messages or receive messages upon its own terms and stipulations as long as they are reasonable. The fact that this telegraph company does so for the telephone system of the Bell Telephone company is a personal privilege or right they may exercise as they see fit. For these reasons the application must be denied.

## Proposed Amendment to Bill Authorizing Metric System.

[Special correspondence WESTERN ELECTRICIAN.]

WASHINGTON, D. C., March 18. The committee on coinage, weights and measures, to which was referred the Hurley bill to fix the standard of weights and measures by the adoption of the metric system of weights and measures, has presented an amendment in lieu of the original bill which reads as follows.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after the first day of July, eighteen hundred and ninety-eight, all the departments of the government of the United States, in transaction of all business requiring the use of weight and measurement, except in completing the survey of public lands, shall employ and use only the weights and measures of the metric system.

That from and after the first day of January, nineteen hundred and one, the metric system of weights and measures shall be the only legal system of weights and measures recognized in the United States.

That the metric system of weights and measures herein referred to is that in which the ultimate standard of mass or weight is the international kilogram of the International Bureau of Weights and Measures, established in accordance with the convention of May 20, 1875, and the ultimate standard of length is the international meter of the same bureau, the national prototypes of which are kilogram numbered twenty and meter numbered twenty-seven, preserved in the archives of the office of standard weights and measures.

That the tables in the schedules annexed to the bill authorizing the use of the metric system of weights and measures passed July 28, 1866, shall be the tables of equivalents which may be lawfully used for computing, determining and expressing the customary weights and measures in the weights and measures of the metric system

## English Aldermanic Debate

[From London *Electricity*.]

Here are some gems of repartee from the proceedings of this sagacious body [the West Ham Town Council]. A councillor charges Alderman Govier with "being led home every night." The alderman retorts by calling his adversary "a viper." The councillor points out that he had received provocation, inasmuch as the alderman had interrupted one of his speeches by calling out "Sit down and go where you have come from and have a little more tea." Whereat the alderman called the councillor "a lying scoundrel and a cad," and the councillor in great warmth threatened to "punch his head for him." And all this occurred in the course of a debate upon the introduction of the electric light. It shows very clearly the caliber of the men who compose the town council, and what sort of work may be expected of them.

Gladstone, Mich., will vote April 6th on bonds for an electric light plant.

FIG. 4. ELECTRICITY IN ALGERIA.—MÉCHOUAR PROMENADE

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**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

**ADVERTISING.**—THE WESTERN ELECTRICIAN — **the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

## HIGH WATER MARK

CIRCULATION, 16,630.

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The publication offices of the WESTERN ELECTRICIAN have been removed to much more commodious quarters. Our new address is Suite 510 Marquette building, Dearborn and Adams streets, Chicago.

The telephone number remains unchanged—Main 1746.

SINCE 1746 experimenters have been studying the effects of electricity on vegetable life, and have sought to formulate some law governing the relations between the two. Until quite recently these attempts have proven futile, contradictory, or of negative value, so that there was but little encouragement for investigators. Professor Lemstroem, in 1885, decided to abandon laboratory experiments, and he has since been conducting tests upon an extensive scale upon a large experimental field in Finland. These latter experiments were begun in 1888. The ground was covered with a reseau of insulated wires separated about one meter, and at intervals of half a meter throughout their extent branch wires were brought down quite near the soil. This combination of wire escapes was connected to the positive pole of a generator, the negative pole being connected to earth at the station. The current was continuous for seven or eight hours per day for about two months—up to harvest time—when it was found that the yield was augmented about one-third. From the results M. Lemstroem formed the conclusion that vegetables may be divided into two groups —those in which development is aided by electricity, including wheat, rye, barley, oats, beets and potatoes; and those which are not favorably effected by electricity, as for instance, peas, carrots, cabbage-radish, cabbage-turnips, turnips and tobacco. It was also noted that these effects were geographically universal, and that during the heat of summer it was necessary to withhold the current in the middle of the day, as the combination of heat and electricity, it was found, was deleterious to vegetation. Professor Lemstroem's experiments might well form the subject of investigation at the hands of the agricultural department at Washington. An addition of one-third of a crop of the most valuable farm products such as is promised by this report, would be a sufficient inducement to the authorities to encourage these researches, and inaugurate experimental stations in various parts of the country. The expense of establishing and conducting these would be but a trifle in comparison with the value of such an object lesson, provided, of course, the government authorities found upon examination that the reports which we have referred to were authentic and reliable.

AS PREDICTED by our special correspondent at Niagara Falls last week, the affairs of the power companies of that locality and the legislation now pending at Albany affecting the rights of these corporations and the continued existence of the reservation commission are attracting considerable attention, not only at Niagara Falls and Albany, but throughout the state and nation. The proposal to legislate the reservation commissioners out of office has raised a storm of opposition to the power companies' plans and it is possible that this agitation growing out of this movement may result in the defeat not only of the measure aimed at the commissioners, but also the failure of the bill favoring the extension of privileges to the power companies. Evidently it was a very ill-advised movement on the part of the power companies to attempt to secure the removal of the commissioners, because they in the discharge of their duty have considered it necessary to oppose the plans of these corporations. It may be true that the attitude of the commission toward the power companies tended to jeopard the vast financial interests involved; but this does not seem to be considered unfavorably by the people and the press throughout the state. On the contrary, there is every indication that it is the wish of the people that the commission be upheld. It seems to us that the dangers to the beauty and grandeur of the Falls which the commissioners appear to fear from the plans of the corporations have been greatly exaggerated, if indeed they have any foundation in fact. But we do not consider the retaliatory measures adopted by the power companies as good business policy. It was to be expected that this aggressive policy would meet with disapproval throughout the state, and even though the companies may secure the extension of the privileges they desire, it is to be feared that their action in this case will leave a bad impression in the public mind, which is very unfortunate, as the day has passed when corporations seeking privileges from the people can disregard public sentiment

ELECTRIC railway companies doing suburban or cross-country business may well profit by the hard-earned experience of the steam roads in such an important matter as train dispatching. A recent head-end collison on a single-track electric railway in the outskirts of St Louis, in which several persons were killed or injured, revealed a reprehensible laxity in the manner of running trains. There were no printed rules, no system of train dispatching, the motormen were simply expected to "obey orders" made by the general manager. There was a general but rather indefinite understanding as to the right of way of trains proceeding in different directions, but this plan varied with the time of day and was subject to change by telephonic orders sent and received in loose, haphazard fashion. The whole "system," it appears, was criminally careless. Trains frequently met on the single track, one backing before the other, and it was perfectly permissible for a motorman to "steal a switch" or siding if he could do so. It was while one train crew was trying to do this trick that the accident and loss of life of March 8th occurred.

This sort of "railroading" will receive the prompt and severe condemnation of electrical men. It tends to discredit the new method of transportation at just the stage of development when the public, still dubious of the practicability of electric traction for considerable distances, can be easily prejudiced. The electric railroad is all right, but new companies, whether operating across country or on streets and roads, must not delude themselves with the idea that cheap men and disregard of needful precautions for safety will successfully supplement a system of pronounced economy of construction and operation. The best in steam railway practice is none too good for electric roads under similar conditions. Where companies operating electric railways offer service equivalent to that heretofore given by the steam lines, they must exercise at least as much care and thoroughness in train operation as have been drilled into the operation of the older roads after years of experience. How else can the electrical railroad man ask to be entrusted with the lives and property of the patronizing community? The electric line should be not only the cheapest and most convenient, but the best and safest. It can be made so, but not without thorough system and careful, well trained employes.

IT would seem to be most appropriate at this time for the American Institute of Electrical Engineers to take up the subject of the adoption by Congress of the bill now before that body, providing for the introduction of the metric system in this country, and make an effective campaign in behalf of the measure. As a scientific body, we have no doubt that the Institute would favor the change, and with its large membership throughout the country it ought to be able to direct public attention to the measure and influence public sentiment in its behalf. It would seem scarcely necessary to enumerate the advantages to be derived from the adoption of this measure, inasmuch as scientists in every part of the world use the metric system in making their calculations. To change these calculations from the metric system into our own is an awkward task and one that the technical press of this country is constantly called upon to perform in order to reproduce for the benefit of American readers the scientific papers prepared abroad. But the principal reason why the proposed bill should pass is that the metric system is constructed upon scientific principles and is based upon a natural and invariable standard, while that in vogue in this country is arbitrary, complicated and inconsistent. It was for the very purpose of overcoming these objections and removing the confusion arising from the diversity of weights and measures prevailing in the several countries of the world that the metric system was devised. Each measure of length, weight and volume bears a relation to the others in the metric system, and during the hundred years in which it has been in practical use it has gained adherents in all parts of the world, until to-day it is the officially recognized standard of a vast majority of civilized nations and the accepted authority of scientific men everywhere. It has been contended that such a radical change would entail great confusion, but the inconveniences mentioned would be only temporary and would be followed by such lasting benefits that everybody would feel amply repaid. Besides, the history of the introduction of the metric system in other countries does not support the contention of the opponents of the proposed measure as to the confusion thus entailed. At the present time a large number of the people of this country are already familiar with the metric system, and the younger generation would find it very easy to master its principles. There would of course be some confusion, but this is to be expected in all great movements involving innovations and far-reaching reforms. Here is certainly an excellent opportunity for the Institute to display its interest in the advancement of science and exert its influence in promoting a public measure that comes rightfully within its scope.

## Lincoln Park Lighting Plant.

For several years the commissioners of Lincoln Park, Chicago, have conducted a small electric lighting plant at the power house, near the Lake Shore drive, opposite Webster avenue. This plant had a capacity of about 50 arcs and included also a Jenney incandescent machine. It has long been considered inadequate and out of date, however, and the commissioners are now expending about $40,000, under the direction of Superintendent H C Alexander and Engineer A. A Babcock, in extending and remodeling the plant to make a modern installation, having a capacity of 230 arc lamps of 2,000 candle power each and 750 incandescent lights. This is considered amply sufficient for the out-door illumination of the present area of the park and for lighting the shops and the Academy of Sciences building, which contains the offices of the commissioners.

Work is under way on a brick extension to the power house 40 feet square, with new engine foundations. The plant will consist of two 100 horse power compound condensing engines directly belted to three 80 light arc dynamos, leaving room and engine capacity for a fourth arc machine of the same size, with an additional 100 horse power engine driving a 750 light alternator and two small Brush arc dynamos which are used in summer to operate the arc lights in the Yerkes electric fountain. The present boiler plant is sufficient to supply steam to the new engines. The wiring will be in underground cable laid in steel pipes, and 240 iron lamp-posts used for the arc lighting at the World's Fair have been purchased from the World's Columbian Exposition company at $12.50 each. The switchboard will be put in by the dynamo contractors, and the matter of arc lamps is still in abeyance. Contracts for the remainder of the new apparatus required have been awarded as follows:

Engines—Buckeye Engine company, Salem, O., for $5,925. (This includes the two new engines and the removal of an old Ideal 100 horse power engine from the propagating house to the new plant to drive the alternator).

Arc dynamos—Excelsior Electric company, New York, for $4,414.

Alternator—Westinghouse Electric & Manufacturing company, Pittsburg, for $1,138.

Cables—Western Electric company, Chicago, for 9.7 cents per foot. (About 85,000 feet will be required.)

Conduit (steel pipe)—R. & A. Coleman, Chicago, for $7.35 per 100 feet for 1½ inch pipe and $9.35 for two-inch pipe.

It is hoped that the plant will be ready for operation by June 1st. The arc lamps will be burned from sunset until 11 P. M.

## Secrecy of Telegraphic Dispatches.

The recent decision of Chancellor Sneed of Tennessee that telegraphic dispatches are privileged communications, and that their secrecy may not be violated by the courts except in the most extraordinary emergencies, was based not alone upon the law of the state that telegraphic messages are confidential, but also upon abstract reasoning from the point of view of common law. Not the least of the obligations indispensable to the efficient operation of the telegraph as a commercial agent, the chancellor said, is the confidential relation between the agencies of the telegraph and its customers. There is no instrumentality in public or private business which the people have to draw more closely into their confidence. To rule, as courts have done, the chancellor continues, that agents of a telegraph company might at any time be called into court to betray matters which came to their knowledge in the transaction of their business, is a "violation not only of public policy, but of the rules of right and the implied contract of the parties. Aside from the positive legal restriction, it would seem that the usefulness of the telegraph as a commercial agent would be irretrievably impaired by the practice referred to, as the most important correspondence between the commercial man and his agent, a correspondence on which fortunes may depend, is often carried on through the telegraph, in which the most delicate questions are sometimes in good faith asked and answered, and in which other men's affairs are brought into question in a manner that may lead to trouble or litigation when no harm was intended. It would seem just as reasonable to establish a judicial espionage over the mails and to compel the postmaster to surrender or break open letters and reveal the secrets of all or any private correspondence that may come into his possession."

## Electricity Supplanting Gas.

[From the Rochester *Post-Express*.]

An act to regulate the price of illuminating gas in cities of the first, second and third classes of this state has been introduced in the Assembly. The bill has been referred to the committee on cities.

The act provides that the charge for illuminating gas in cities of the first class shall not exceed $1 per thousand cubic feet; in cities of the second class not over $1.50, while in cities of the third class $1.75 shall constitute the maximum price for 1,000 cubic feet. The act, if passed, will go into effect September 1st next.

The provisions of this bill will not affect the price of gas in this city, as it is at present lower than the bill calls for.

Gas is being discarded more and more for factory and store use in this city, being supplanted by electric light. There is no city in the United States where electricity has been so generally introduced with such all around satisfaction as in this city. The use of gas here now is principally confined to residences, and of late it is supplanting coal for cooking in many households. This is particularly the case in summer, when the gas gives but little heat and leaves the kitchen comfortable and comparatively cool.

## National Conference on Standard Electrical Rules.

A conference upon the rules for the installation and operation of electrical apparatus was held in the hall of the American Society of Mechanical Engineers at 12 West Thirty-first street, New York, on Wednesday and Thursday of last week. The gathering consisted of representatives of the electrical, architectural and insurance interests, who were called together by invitation of a committee of the National Electric Light association.

The meetings were presided over by William J. Hammer of New York, consulting electrical engineer, and C. J. H. Woodbury of the engineering department of the American Bell Telephone company is secretary. A committee made a report on organization. The rules of the National Board of Underwriters on electrical installations were read section by section and formed the basis of extended discussions, in comparison with other similar rules, both foreign and American. The question of rules was referred to a special committee, which will submit a report at some subsequent session of this body. This committee consists of F. B. Crocker, Frank R. Ford, W. H. Merrill, Jr., Alfred Stone, William Brophy, E. V. French and E. A. Fitzgerald.

The representative character of the gathering is well shown by the list of those present in official capacity, in addition to Mr. Hammer: Prof. Francis B. Crocker of Columbia College, representing the American Institute of Electrical Engineers; Frank R. Ford, American Street Railway association; William H. Merrill, Jr., of Chicago, electrician of the National Board of Fire Underwriters; A. S. Brown, Western Union Telegraph company; Francis W. Jones, Postal Telegraph company; Alfred Stone of Providence, R. I., secretary of the American Institute of Architects; Capt. William Brophy of Boston, International Association of Fire Engineers; C. J. H. Woodbury, American Bell Telephone company; Lieut. S. Dana Greene, New York, General Electric company; Charles F. Scott, Pittsburg, Westinghouse Electric & Manufacturing company; E. A. Fitzgerald, Underwriters' National Electric association; Edward V. French, electrical inspector of the Associated Factory Mutuals of Boston.

## Does Vibration Make Metals Tough?

The notion that a constant jarring or vibration tends to make metals brittle is one which is thoroughly imbedded in the minds of the majority of so-called "practical" men, notwithstanding the evidence which has been presented at various times that no such supposed effect occurs. To the people who still adhere to this time-honored superstition the *Engineering News* especially commends a paper by Mr. Outerbridge, in which he claims to show that cast-iron is actually made tough by jarring or shock, instead of being crystallized and weakened. The interest of this new discovery from a scientific point of view is evident, and it promises also to prove of no small practical importance. If cast-iron can be toughened without the use of heat by simply subjecting it to light jars, it is entirely possible that many castings and forgings of iron, steel, other metals, and even of some classes of earthenware, might be annealed in this manner.

## New Sources of India Rubber.

A journal devoted to the india rubber and gutta percha trade states that the fear among electricians that an artificial rubber would have to be resorted to in consequence of the increasing scarcity of the natural product has for the present, at all events, been allayed. In many rubber sources the wholesale destruction of trees by the natives has been stopped, and odd kinds of rubber are cropping up from unexpected quarters. Several new sorts, together with the familiar little black balls with white center, come from the east coast of Africa. A new product comes from Madagascar. It has a horny appearance and contains much earth. Nothing certain is known of its botanical origin. From New Zealand have been received packages of a rubber, which appears very elastic, but which does not bear cutting up well. It is the product of the banyan, and the rapidity and facility with which this tree reproduces itself is an important factor, in view of the wasteful methods still adopted by the natives, who practically destroy the tree in order to obtain the rubber. Improvements and economy in the manufacture of rubber have also been effected by the use of more efficient machinery and especially by the adoption of large rollers. So far it has not been possible to completely eliminate the sulphur contained in vulcanized rubber, and all processes for the regeneration of old rubber are more or less unsatisfactory.

## Needed Patent Office Legislation.

[From the *Scientific American*.]

Year by year the lack of ample appropriations to provide a sufficient force at the Patent Office for the rapid conduct of business becomes more manifest and should lead all legislators interested in the welfare of their country and the progress of invention to regard this as a useful branch of the government with liberal ideas of its needs. Inventors, we presume, as a rule, do not appreciate the power they might have in shaping good legislation for their interests by personally urging upon the respective representatives and senators from their section of the country the necessities for more liberal laws regarding patents and the enlargement of the Patent Office facilities.

In view of the vast number of patents already issued and the increasing number of applications now been made each week, the new bill introduced in the House of Representatives and Senate at Washington during the present session, and known as a bill "to establish a classification division in the United States Patent Office," is most timely and is a step in a direction which will be of great service and utility to inventors in the future. It has the unanimous approval, not only of the officials of the Patent Office, but of every sincere friend of the inventor, and has been favorably acted upon by the committees in the House and Senate. We hope there will be no unnecessary delay in its becoming a law, and that there will be no pruning of the amounts asked for.

The bill provides for the establishment in the Patent Office of a new division, to be called the "Classification Division," to be managed by one primary examiner, having a salary of $2,750 per year; two first assistant examiners, each a year; two second assistant examiners, at $1,600 per year; three third assistant examiners at $1,400 per year; and thirty-six fourth assistant examiners at $1,200 per year, and clerks, copyists and messengers—in all equal to $64,500. Each person is to be appointed by the secretary of the interior upon the nomination of the commissioner of patents, subject to the rules and regulations of the civil service commissioner.

"The commissioner of patents shall assign to this division the duty of preparing a philosophical classification of the subject matter of all letters patent which have been granted in this and in the foreign countries, and of printed publications which constitute the field of search in ascertaining the novelty and patentability of applications for patent, together with such other duties having relation hereto as may be considered necessary by the commissioner."

Not only will the methodical and uniform classification of the letters patent issued by the United States be effected, but also the patents of foreign countries and printed publications; this certainly will be a great gain, by enabling inventors or their solicitors, when making searches in regard to the novelty of inventions, to do so on an equal footing with the examiners of the Patent Office, in addition to affording the latter facilities for the quicker disposition of applications.

When such legislation is demanded, by all conversant with the needs of the Patent Office and is urged by the officials connected therewith, there should be no doubt about its being enacted. The sooner the better.

## New Use for the Phonograph.

A remarkable experiment with the phonograph has been made in connection with a large pumping works on the Elk river in California. The machinery, which had been erected by a New York firm, after several years got out of order, and with a view to avoid, if possible, the great expense of having an expert sent so many thousands of miles to put the machinery into working order again, the manager tried an ingenious plan, described in *Power*. He first spoke into the receiver, giving a full and general account of what he found to be the matter with the pumps; then he brought the receiver close to the machinery, so that the peculiar sounds of the pulsation of the defective pump might be recorded on the wax roll of the wonderful machine of Mr. Edison. The cylinder, on arrival in New York by post, was placed in the machine, and then the voice of the Californian was heard describing what he observed to be the symptoms of the diseased pump and finishing by telling them to listen to the pump's action, which was imitated absolutely by the machine from the wax cylinder. The ingenuity of the manager was amply rewarded, for the curious experiment was a complete success. The wax roll enabled the experts in New York to diagnose the disease, the proper remedy was suggested, and the pump set running, so that the expense of sending a competent man from the Atlantic to the Pacific coast was saved.

The Citizens' street railway of Kalamazoo, Mich., formerly the property of J. W. Johnson, T. P. Bailey and other electrical men of Chicago, has been sold to an organization composed almost entirely of local capitalists, as follows: J. B. Wyckoff, L. M. Gates, J.W. Osborn, D. B. Merrill, Fred N. Rowley, L. M. Downs and E. E. Downs. The Messrs. Downs are largely interested in the Battle Creek and Lansing street railways, and E. E. Downs was formerly manager of the street railway in Kalamazoo. He will again become manager under the new regime. A number of extensions and improvements are contemplated by the new company.

## Thomson Measuring Instruments for Alternating Currents.

A complete line of new indicating instruments has lately been developed by Professor Elihu Thomson and is being introduced by the General Electric company to meet the demand for low-priced, compact, permanent and accurate instruments for use on all alternating current circuits, irrespective of frequency. These instruments are known as the Thomson inclined coil portable standard instruments and comprise an ammeter, a voltmeter (Figs. 1 and 2) and an indicating wattmeter (Fig. 3). They are introduced as standards of the highest grade for all alternating current measurements. The scales are exceptionally long and clear, and a depressible

Fig. 1. Alternating Current Voltmeter.

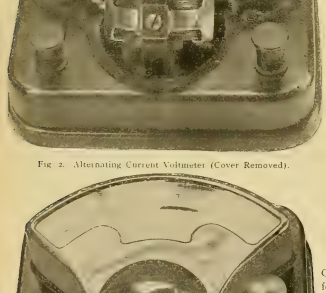


Fig. 2. Alternating Current Voltmeter (Cover Removed).

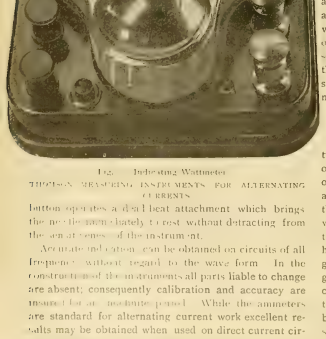


Fig. 3. Indicating Wattmeter.

THOMSON MEASURING INSTRUMENTS FOR ALTERNATING CURRENTS.

button operates a dead beat attachment which brings the needle immediately to rest without distracting from the accuracy of the instrument.

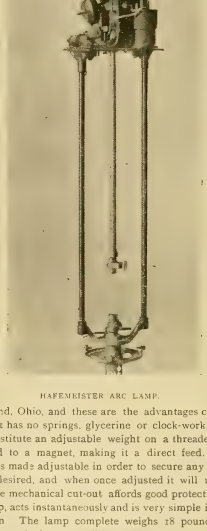
Accurate indications can be obtained on circuits of all frequency without regard to the wave form. In the construction of the instruments all parts liable to change are absent; consequently calibration and accuracy are insured for an indefinite period. While the ammeters are standard for alternating current work excellent results may be obtained when used on direct current circuits, provided a high degree of accuracy is not required.

The indicating wattmeter gives accurate readings with angles of lag on all inductive loads met with in commercial practice. These wattmeters will be found especially valuable in testing and calibrating recording meters, testing transformers and measuring their efficiency; testing alternating current arc lamps, incandescent lamps, fan motors, etc. The 1,000 watt indicating wattmeter has been especially designed for testing incandescent lamps. In using the wattmeter for direct current measurements two readings are necessary, the connections being reversed between the two—the mean of these two readings giving the correct result.

These instruments are made in sizes to meet the ordinary requirements of commercial practice. The ammeters are made to read from 0 to 2, 10, 25, 50, 100 and 200 amperes. The indicating wattmeters from 0 to 100, 300, 1,500 and 2,500 watts. They are said to be accurate at any potential from zero to 150 volts, and the limit of current for each instrument is plainly marked upon it. The voltmeters are made to read from zero to 75 and 150 volts.

## Hafemeister Arc Lamp.

The constant current arc lamp which is herewith illustrated is a shunt lamp and will burn on any circuit of from five to 10 amperes. It is built by the Hafemeister Electric & Machine company, 24 Superior street,



HAFEMEISTER ARC LAMP.

Cleveland, Ohio, and these are the advantages claimed for it: It has no springs, glycerine or clock-work, using as a substitute an adjustable weight on a threaded stud attached to a magnet, making it a direct feed. This weight is made adjustable in order to secure any length of arc desired, and when once adjusted it will remain so. The mechanical cut-out affords good protection for the lamp, acts instantaneously and is very simple in construction. The lamp complete weighs 18 pounds and measures 42 inches over all.

## Ideal Steam Oil Refiner.

In the oil filter herewith illustrated, which is manufactured by the Purity Oil Filter Manufacturing company of 899 Water street, Pittsburg, Pa., the waste or drip oil is poured into the receiver *A*, where all coarse articles are arrested by a fine strainer. The oil passes down through pipe *B* and is discharged in water that has been warmed to a temperature of 150 degrees by a steam coil that is directly under the water, but not in it. All the heat is by radiation. It is consequently impossible to get the oil or water so hot that it will boil. The waste oil gathered each day is poured in the same way until the chamber *E* is filled, which will take four or five days; the next day's oil will displace the oil poured in the first by overflowing it into pipe *F*, passing out in water, the second time in chamber *J*. Here it cools. When the oil rises, so that it can by drawn from faucet *f*, it is cold and ready for use again.

A glass gauge is on each chamber that indicates the amount of oil and water that may be in each. The faucets *K* are for regulating the water and for drawing off the sedimentary matter that may accumulate in the refiner. The pan *H* catches the refuse that may settle on it. It is the full diameter of the shell. This can be withdrawn at any time without drawing off the oil and water, by lifting off the refining chamber *E* and taking hold of the pipe in the center and pulling up slowly. When out it can be emptied and cleaned in a few minutes, then replaced and allowed to gravitate to its original position, which will not disturb the oil. The refining chamber may then be replaced and steam connections made as before.

The steam coils are one half-inch diameter pipe. Only enough opening in the discharge valve to free the coil of condensation is required. Very little steam is used. It will be seen that the oil has passed through no filtering material or substance. Consequently there is nothing that will require to be renewed except the water.

IDEAL STEAM OIL REFINER.

## The Electric Treaty.

["Matthew Marshall" in the New York *Sun*.]

An era of peace, not only between this country and foreign powers, but also between rival domestic manufacturing corporations, seems about to succeed to the wars and rumors of wars which have disturbed Wall street, more or less, ever since the appearance of the president's Venezuela boundary message. It has become quite evident that public sentiment in Great Britain will not sustain Lord Salisbury in his refusal to arbitrate with Venezuela; nobody has ever seriously believed that we shall provoke a conflict with Turkey on behalf of the Armenians, and neither has Congress done anything yet with regard to the Cuban revolutionists, nor is it likely to do anything which Spain can make a cause of war. Fears of collision with these nations have, consequently, nearly vanished, and, to add to the good feeling thus created; has come the announcement that the General Electric and the Westinghouse companies have made a treaty of peace, which, if nothing more, will put an end to the litigation in which the two have been so long engaged.

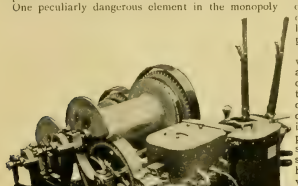
As usual, the speculators for a rise in General Electric stock, who had early information of the negotiations which have resulted in the peace just announced, overestimated its beneficial effects upon the market. The stock, which, since last January, had been gradually going up from 22 to 35, jumped, upon the news of the making of the treaty, nearly to 40, but immediately receded and closed finally on Saturday at 37. This shows that the uniformed public is not convinced that the cessation of the war between the two companies guarantees anything more than a cessation of the losses resulting from the previous hostilities. Whether, eventually, positive profits will be reaped, is not yet certain. The common stock of the General Electric company amounts to $30,460,000, besides preferred stock of $4,250,000, and five per cent. gold debentures of $8,900,000. No dividends on the common stock have been paid since August, 1893, and none on the preferred since October, 1893. How soon they will be resumed on either it is not safe to predict.

Warfare is, indeed, the natural condition of the world. To the struggle for existence and the survival of the fittest is due the present perfection of all forms of organic life and the state of development to which the human race has arrived both spiritually and materially. The process, however, is so evidently destructive, and apparently so needless, that, from the earliest times, religion, philosophy, science and philanthropy have labored assiduously to diminish the suffering it occasions, and to substitute for it a less painful method of reaching the results to which it leads. All that has been accomplished thus far has been mitigation and not extirpation. Nations still make war upon nations, individual men beat, maim and murder individual men, and though crimes of violence have become less frequent, they have been supplemented by frauds, thefts and in business affairs by a competition which, as we see, produces a suffering quite as hard to bear as blows, wounds and highway robbery.

Nor are the means employed to suppress business competition, even when successful, altogether without mischievous tendencies of their own. Trades unions have nearly put an end to the struggle between skilled laborers for employment and to the lowering of wages

which this struggle entails, but they deprive the individual laborer of much of his freedom, and, if he has unusual skill, of the full measure of compensation which he would otherwise obtain In commerce and manufactures similar combinations protect those engaged in them from a reduction of their profits, but they kill enterprise, check improvement, and add to the burdens of consumers Hence the legislation in modern times intended to prevent such combinations and the hostility to them of public opinion Monopolies are always odious, and are always liable to overthrow as soon as their true character is perceived.

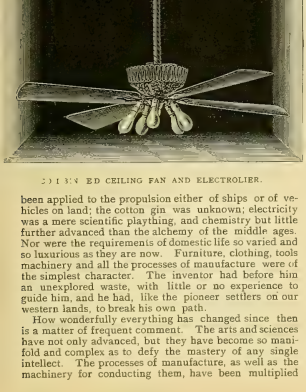
One peculiarly dangerous element in the monopoly



PORTABLE ELECTRIC DERRICK HOISTS.

which the new alliance of the General Electric with the Westinghouse company tends to create is that it is supported mainly by the possession of important patent rights, which are themselves monopolies of the most stringent kind. In fact, the reason given for making the alliance was that each one of the high contracting parties owned patents without which no other company could carry on its business. Hereafter, therefore, the two combined can prevent all rivals from manufacturing on any but virtually prohibitive terms the machines and apparatus to which their common patents are essential. The temptation to abuse the power thus created will be enormous, and only the wisest discretion in its exercise, such as, for example, has marked the management of the monopoly by the Standard Oil Trust of the petroleum supply of the country, will avert legislative attempts to destroy it.

It is a question, indeed, whether the time has not come to abolish altogether our patent laws, and to recompense in some other way than by giving them monopolies the inventors of new contrivances and processes. When our Federal Constitution was adopted a century ago, vesting in Congress the power of "securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries," it was expressly said to be done "to promote the progress of science and the useful arts." At that date steam had not



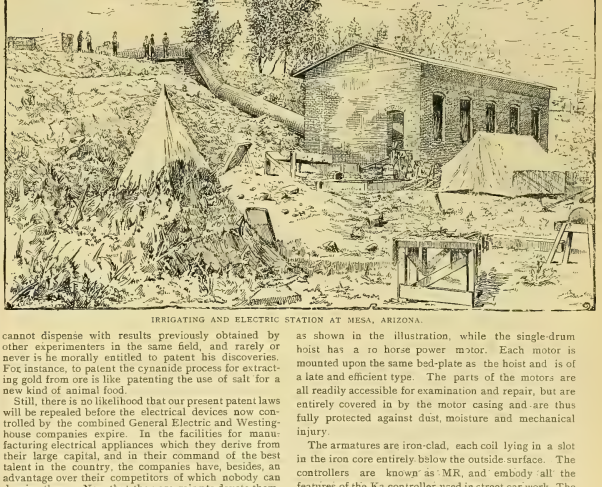
ENLARGED CEILING FAN AND ELECTROLIER.

been applied to the propulsion either of ships or of vehicles on land; the cotton gin was unknown; electricity was a mere scientific plaything, and chemistry but little further advanced than the alchemy of the middle ages. Nor were the requirements of domestic life so varied and so luxurious as they are now. Furniture, clothing, tools machinery and all the processes of manufacture were of the simplest character. The inventor had before him an unexplored waste, with little or no experience to guide him, and he had, like the pioneer settlers on our western lands, to break his own path.

How wonderfully everything has changed since then is a matter of frequent comment. The arts and sciences have not only advanced, but they have become so manifold and complex as to defy the mastery of any single intellect. The processes of manufacture, as well as the machinery for conducting them, have been multiplied and divided past comprehension, and into every day life a wealth of contrivance has been introduced which from luxuries have passed into necessities, and add to the cares of the housekeeper as much as they do to the comforts of the home On the details and items of all this progress long patent rights of various kinds, which, as Sydney Smith said of the fiscal system of Great Britain in his famous warning to this country, impose "taxes upon every article which enters into the mouth, or covers the back, or is placed under the foot taxes upon everything which it is pleasant to see, hear, feel, smell or taste taxes upon warmth, light and locomotion" Not only do they thus burden consumers, but in the hands of ingenious manipulators they are made instruments for harassing innocent infringers, and for impeding the improvement they were created to promote.

For a multitude of modern inventions, too, the inventors deserve little or no recompense. Some of them are lucky accidents, like picking up a coin or a jewel dropped upon the highway, others are trifling modifications of earlier inventions, costing scarcely any exercise of ingenuity, and all of them are based upon previous contributions to general knowledge of a host of workers in various fields of research. Undoubtedly, if a man patiently works out an elaborate piece of machinery, such as a Hoe perfecting press, and expends in constructing it much time and money, it is but right that he should be protected in the exclusive use of it, but when, as is often the case, he merely puts a familiar device to a new use, such as driving down a pipe to draw water from the earth, and bases his claim to a patent upon a priority in time of a day or a week, the justice of giving him a monopoly of that use cannot be maintained. In chemical processes particularly an inventor cannot dispense with results previously obtained by other experimenters in the same field, and rarely or never is he originally entitled to patent his discoveries. For instance, to patent the cynanide process for extracting gold from ore is like patenting the use of salt for a new kind of animal food.

Still, there is no likelihood that our present patent laws will be repealed before the electrical devices now controlled by the combined General Electric and Westinghouse companies expire. In the facilities for manufacturing electrical appliances which they derive from their large capital, and in their command of the best talent in the country, the companies have, besides, an advantage over their competitors of which nobody can deprive them. Now that they are going to devote themselves to the warring upon each other, and more to earning dividends for their stockholders, they will have an opportunity of demonstrating that a legitimate business can be profitable without being extortionate.



IRRIGATING AND ELECTRIC STATION AT MESA, ARIZONA.

## Combined Ceiling Fan and Electrolier.

The attractive device shown in the illustration is one of a complete line of electric fans manufactured by D. L. Bates & Brother of Dayton, O. It is an electric ceiling fan combined with an ornamental incandescent light fixture. The lights revolve with the blades and give a very pleasing effect. The blades may be removed, during such seasons as the use of the fan is not desired, and the remainder used simply as an electrolier. The motor, which is wound either for a 110, 220 or 500 direct current circuit, is concealed within the ornamental metallic basket. It has been on the market a long time and its running qualities are well known and appreciated. The fans are furnished either with or without lights as desired and to suit any height of ceiling. They are also mounted on pedestals of different sizes. These fans are handsomely finished in nickel, oxidized copper or polished brass and are furnished in a variety of styles.

## Irrigating and Electric Station at Mesa, Arizona.

In the special water power plant constructed by the Stilwell-Bierce & Smith-Vaile company of Dayton, Ohio, for the Consolidated Canal company, Mesa, Arizona, the water is taken from the Salt river and carried by 48-inch feed pipe across the Utah canal to a pair of 21-inch cylinder gate Victor turbines on a horizontal shaft, developing 400 horse power under 40 feet head. One end of the shaft is connected by a friction clutch to a 200 horse power dynamo, which furnishes light and power for the town of Mesa. The other end of the shaft is connected to a pumping plant for irrigating purposes. This novel plant, herewith illustrated, is suggestive of further possibilities in this line.

## Portable Electric Derrick Hoists.

The application of the electric motor to portable hoists for derricks is well illustrated by two hoists which the General Electric company has lately furnished the United States government in connection with an important electrical installation. These hoists are of the double-drum and single-drum type respectively. The double-drum hoist is operated by a 20 horse power motor, as shown in the illustration, while the single-drum hoist has a 10 horse power motor. Each motor is mounted upon the same bed-plate as the hoist and is of a late and efficient type. The parts of the motors are all readily accessible for examination and repair, but are entirely covered in by the motor casing and are thus fully protected against dust, moisture and mechanical injury.

The armatures are iron-clad, each coil lying in a slot in the iron core entirely below the outside surface. The controllers are known as MR, and embody all the features of the K2 controller used in street car work. The levers for the brakes, controllers, etc., are so arranged that full control of the entire mechanism is had without change of position by the man in charge. The hoists themselves are from the works of the Lidgerwood company. The drums are 14 inches in diameter and 26 inches long.

## Introducing Drugs into the Body by Electricity.

There has been considerable talk of late in relation to the possibility of introducing drugs into the human body, through the skin, by means of a current of electricity. This account is given of a New York experiment of this character in the treatment of headache:

Suppose the pain has its seat in the left side of the head. The foot on the opposite side of the body is bared and placed on a zinc plate. Under it is placed the negative electrode. A wet sponge and a layer of starch are applied to the sole of the foot. The positive electrode is placed on the left temple. On this disc is also placed the amount of morphia, or whatever drug it is desired to administer, and a direct current of electricity is passed through the body. When a drop of

iodine is placed on starch it changes the color of the starch to a deep blue or purple. The electrode, covered with the morphia, is applied to the temple. Within 60 seconds usually the same change begins to take place in the starch under the foot as is produced by the direct contact with iodine. The longer the electrode is applied to the temple the deeper the purple color of the starch. There are none of the sensations usually accompanying the application of electricity to the head. When the electrode is placed against the temple a slight stinging sensation results, which gradually changes to numbness. The pain in the head disappears.

### The Metric System.

We are glad to notice, says the *Engineering and Mining Journal*, that serious consideration is being given by the House committee on coinage to the bill introduced by Mr. Hurley of Brooklyn, to make the metric system mandatory in all official and private transactions. This is a measure that we have never failed to advocate, and it is impossible for us to understand how anyone with the commonest of common school education could fail to see its advantages. Practically the metric system, so far as possible, has been adopted by every scientific body, and to a certain extent, though not officially admitted, in various of our government departments; that is to say, for the sake of simplifying, facilitating and shortening work, though not recognized. Nearly every civilized nation in the world now uses the metric system in its official transactions, and to quote an example from our nearest enlightened neighbor, the Republic of Mexico, this system was introduced by law, some 10 years ago, in all official transactions without the slightest difficulty. For instance, the old lineal measurement, the vara, was quickly exchanged for meter, with the result, that being used on all railroads and officially applied in not only measures but weights, it is being rapidly adopted and found much more convenient by the whole community.

### Changes in "Electrical Industries."

Several important changes in *Electrical Industries* are announced authoritatively The most important is the removal of the publication offices to New York. This will be greatly regretted by the friends of E. L. Fowers in this city. Mr. Powers has labored earnestly and intelligently in building up his publication, and his work is fully appreciated in the West. Personally he is very popular, and he has commended himself to the business interests by his courteous manners and painstaking methods. In his new field he will have the coöperation of Mr. McGraw of the *Street Railway Journal* and Mr. Weaver of the *Electrical World*, who have become interested in the enterprise. Mr. McGraw has many friends in the electrical field and Mr. Weaver is well known as a careful and well informed writer on electrical subjects. With the additional backing thus secured it is believed that the paper will take a prominent place in electrical journalism in the East.

## CORRESPONDENCE.

### New York Notes.

New York, March 21.—The incorporation of the American Institute of Electrical Engineers was accomplished on Monday, the 16th instant. In the incorporation papers filed with the secretary of state at Albany the principal office is given as being in New York city.

At the first meeting of the Rapid Transit Commission since the approval of its underground electric railway plans by the Special Commission of the Supreme Court, Chief Engineer Parsons was warmly congratulated by President Orr and Commissioners Low and Steinway on the success of his profiles for the proposed railway and for the work he had done with the Special Commission. A copy of a letter sent by President Orr to Mayor Strong was read to the board in executive session, asking that a further appropriation be given the Rapid Transit Commission by the city. The last appropriation, according to the letter, was made in December, 1895. The letter met the approval of the members present.

The New York & New Jersey Telephone company has increased its capital stock from $3,500,000 to $5,000,000. Of the new stock $620,000 will be issued for the purpose of improving and enlarging the company's plant. The requirements of the company's business have brought on the necessity of erecting a new building in Brooklyn for the general offices and the principal exchange. New exchanges will soon be erected in Brooklyn and elsewhere within the territory covered by the company. The extension of the trunk line system will be continued, and before the summer it is said that every important point on Long Island will have telephone connection with the system. The growth of the company's business is shown by the fact that in the last year the number of stations increased from 10,102 to 11,883, a gain of 1,781. The following named officers were chosen at the meeting: President, Charles F. Cutler; vice-president and general manager, W. D. Sargent; secretary, Joel C. Clark; treasurer, Henry Sanger Snow; executive committee, Charles F. Cutler, Joseph P. Davis, W. D. Sargent and Joel C. Clark; directors, Charles F. Cutler, New York; Alexander Cameron, Brooklyn; Joseph P. Davis, New York; Charles A. Nichols, Springfield, Mass.; Hugh Kinnard, Newark; William D. Sargent, Brooklyn; David B. Powell, Brooklyn; George H. Prentiss, New York; Joel C. Clark, Brooklyn; Felix Campbell, Brooklyn; Edward J. Hall, New York, and Henry Sanger Snow, Brooklyn.

The Lenox avenue electric conduit road has emerged successfully from the tests to which the severe snow storms of the last month have subjected it. During the violent snowstorm of the 11th of March the operation of the road did not cease for an instant. The snow began to fall about eight o'clock in the morning and the snow sweeper was started out over the line, but before it could make the complete trip the sprocket wheels of the broom broke and it was necessary to push the sweeper back into the barn for repairs. Not until four o'clock in the afternoon was it ready to go out on the tracks again. Meanwhile the service of the road was conducted without any stoppage, and the cars ran over the unswept tracks with no greater delay than would be ordinarily caused by considerable slipping of the car wheels on the snow-covered rails; it took about eight or 10 minutes longer to make the trip. At some points on the line the snow was swept by the wind into drifts, making it necessary for the motorman to back his car to get the necessary momentum to push his vehicle through the drifted snow.

W. F. O.

### Milwaukee, Wis.

Milwaukee, March 21.—The Wisconsin Telephone company has in mind the extension of its system from Madison, the most westerly point now reached by it, to La Crosse. The extension would mean a long-distance connection between Milwaukee and St. Paul and Minneapolis. The Wisconsin company has had the proposed extension under consideration for some time, and it will probably be built this year. The distance from Milwaukee to Minneapolis is 400 miles.

The Oshkosh, Berlin & Omro Railway company, which has been organized recently, proposes to build an electric railway from Oshkosh to Omro and Berlin. The leading spirits in the company, which evidently means business, are Leander Choate, Thomas Wall, Arthur Kellogg, William Dichmann and John Martin. Mr. Kellogg states that the road will be built just as soon as the right of way and the franchises can be obtained.

It has been reported here that Smith H. Bracey of Chicago has signed a contract for the construction of an electric railway from Oshkosh to Neenah and Appleton, a distance of about 40 miles. The project is that of the Central Wisconsin Electric Railway company, whose bonds, it is said, have been placed in Philadelphia. The story is that the cost of the line will be $700,000 and that it is to be completed by August 1, 1896. George H. Ketcham is president and L. M. Ohl secretary of the Central Wisconsin Electric Railway company. The people of the Fox River valley are very desirous of having an interurban line built, but there has been so much talk about the matter, with so little result, that they have naturally become skeptical, and now they are not likely to credit anything of the kind until they see the cars running.

The Milwaukee Electric Railway & Light company does not have to pay any taxes on its electric light plants. Judge Johnson of the Circuit Court has rendered a decision knocking out the assessment of $400,000 on the Edison and Badger lighting plants, which are the property of the street railway company. The law passed by the last Legislature provides that the street railway companies of the state shall, in lieu of taxes, pay one per cent. of the first $250,000 of their gross earnings, 1½ per cent. of the second $250,000 and two per cent. of all earnings in excess of $500,000. It is expressly provided that "such license fee shall be based upon the gross receipts of such person, company or corporation from the street railway passenger business, and shall be in lieu of all other taxes, assessments and licenses of any such corporation, and all personal property, franchises, and real estate owned by such company or corporation shall be exempt from assessment and taxation, except that all lands or lots unimproved or having building thereon owned by any such person, company or corporation shall be liable to taxation for state, county and school purposes." The state, school and county taxes are always mere bagatelles compared with the city taxes, but it will be noticed that even these small taxes can be levied only upon the real estate owned by street railway companies. The city assessed the lighting plants, and the street railway company at once instituted certiorari proceedings to set aside the assessment. Its attorneys claimed that under the law the percentage paid upon its gross passenger business exempted it from all other taxes. The city attorney stated that by the percentage law the street railway company paid only a portion of the taxes that it would otherwise have to pay, and he contended that if the street railway company could escape paying taxes upon its lighting plants by reason of the law providing for payment of a percentage upon its passenger business, then it could buy and operate breweries and any other industrial establishment and escape taxation upon them in the same manner. Judge Johnson said that in his opinion the street railway company should pay taxes upon its electric light income as well as upon its passenger income. The attorney of the company, however, called his attention to the fact that the question of taxes upon electric light earnings was not before the court, which the judge at once admitted, but added that it was a bridge which the company would have to cross. Tax Commissioner Brown made an affidavit in the case to the effect that merchants and other business men who have stocks of goods pay in taxes from 15 to 25 per cent. of their gross receipts, while the street railway company pays only from one to two per cent. There is considerable public feeling over the matter, and it is not likely that the present system of taxing the street railway company will survive the next session of the Legislature. Both the democratic and republican city conventions have inserted in their platforms a demand for the repeal of the street railway assessment law.

The street railway is keeping a sharp eye upon its conductors. It was recently discovered that some of the conductors had been exchanging transfer slips and turning them in as fares, thus defrauding the company. There is a fare register on each car and every fare is "rung up" and counted when it is paid, but the conductors keep the fares in their pockets some time before turning them over to the company. The company found that some of the conductors were meeting at meals and in saloons and swapping bunches of street car transfers, which, when the time to settle with the company came, they would turn in in place of so many nickels. Several conductors were discharged.

C.

### Northwestern Notations.

Minneapolis, March 21.—The local paper at Portland, N. D., thinks an electric light and water plant would pay there.

The electric light and water plant at Le Mars, Ia., will be sold by the sheriff April 15th to satisfy a bonded indebtedness of $23,290 held by T. P. Dalton, trustee. The plant is valued at $150,000, and will be sold without redemption.

The stockholders of the electric light plant at New Ulm, Minn., offer to build up the plant, enlarge the power, put in a moderate arc light outfit, etc., if the city will enter into a contract for increased lighting.

Marquette, Mich., will purchase $10,000 worth of additional light machinery.

Waterloo, Ia., has raised a bonus of $57,000 to secure an electric line to Cedar Falls, with loops in both Waterloo and Cedar Falls. L. S. Cass of Sumner and others will construct the line, which will be about 16½ miles long.

The Electric Light & Power company of Big Timber, Mont., has been incorporated with $5,000 capital stock.

The directors of the street railway company at Janesville, Wis., have decided not to shut down the system, even though it is losing $10 to $20 per day, which comes mostly out of President George W. Bladon of Philadelphia, a millionaire and apparently a philanthropist.

An electric plant at Mapleton, Minn., will soon be advertised for.

The Electric Light company of Hamburg, Ia., has incorporated with $12,000 capital stock.

Arrangements have been completed for the continuance of the St. Cloud (Minn.) City Street Car company lines, Receiver Clark going into possession April 1st. They will about pay expenses.

H. A. Clark of Corning, N. Y., contemplates purchasing the electric light and street railway plants at Beatrice, Neb.

The Redwood Falls, Minn., *Gazette* has a vigorous "kick" on the service of the Western Union there. It

declares that a letter mailed the same time a telegram is sent by that company will arrive as soon as the message, and that this is the case not occasionally, but re gularly, and the company's business has decreased o ne-half by reason of this fact.

B. Ivers and O. F. Engberg attempted to cross the track immediately in front of an inter-urban car in Minneapolis with a buggy, and were both severely injured; the buggy was demolished. This is the first practical use of the fenders with which the cars in Minneapolis and St. Paul have been equipped. The device threw both men clear of the car.

The Sioux City Nursery & Seed company has secured a temporary injunction restraining the Western Union Telegraph company from informing any person that its office is beyond the delivery limits of Sioux City, and that messages cannot be delivered to it, and from refusing to take messages addressed to the plaintiff from any point on its lines and from delaying delivery. The order affects the Western Union Telegraph company and the Iowa Union Telephone company, as the former is bound by contract to use the latter's telephone system only. The Nursery company uses the Home Telephone only, so messages could not be sent by telephone to its office, and the Western Union mailed them, causing material delay. The Nursery company had employed the Postal Telegraph company as its agent to receive and transmit all messages to its office by the Home Telephone and had notified the Western Union to that effect in writing, directing that all messages be delivered to the Postal, which the Western Union refused to do. The Western Union set up that it would be liable for damages unless the messages were delivered to the manager or some one authorized to transact business, but the court held the objection of no effect, for the Postal was authorized to do business for the Nursery company. The case will be tried on its merits later. C.

## PERSONAL.

W. W. McChesney, Jr., of Huebel & Manger, Brooklyn, was in Chicago last week. He is on his way to the Pacific coast.

H. G. Tuckerman, who has for several years represented the *Electrical Review* at Boston, Mass., has accepted a flattering offer to take a prominent position with the Clark Mining company of Wyoming, and will leave in a few days for the West. Mr. Tuckerman will have the best wishes of a host of friends.

## ELECTRIC LIGHTING.

Rheubottom & Bond of Union City, Mich., have been granted a 15 year franchise at Marcellus, Mich., for electric lighting and power plant, the lights to be in operation within six months. The village retains the right to acquire plant at the end of three or five years.

Gas lighting is to be entirely superseded in the First ward of Chicago, which comprises the central business portion of the city, by arc lamps. Heretofore the electric light service has been supplemented by gas lamps, but, owing to a disagreement between the city administration and the gas company, all gas lamps will be removed from the streets.

## ELECTRIC RAILWAYS.

The North Chicago Electric Railway company will build a line on North Robey street from the intersection of Lincoln and Graceland avenues to Rosehill cemetery. Work on this line will be begun as soon as the weather will permit operations. The line will be three miles in length and will be run in connection with the present lines of the North Chicago Electric.

New York and Cleveland capitalists will build a system of interurban electric car lines connecting various cities and towns in northern Indiana. The design, it is said, is to start from Lake county, where the syndicate already owns property, and establish a network taking in South Bend, Valparaiso, Michigan City, Laporte, Elkhart and half a dozen other towns. The syndicate is supposed to be headed by Dan Lamont and ex-Secretary Whitney. Its active agents are ex-Congressman Johnson and Mark W. Hanna.

## TELEPHONE.

Capt. Gallagher of Meridian, Miss., has closed a contract to erect and equip perhaps the largest telephone system in the state. When completed it will cover about 150 miles, connecting some 20 places and terminating at Meridian.

The frauchise of the Michigan Automatic Telephone company of Ypsilanti has been sold on an execution, and B. B. Hazelton bid it in. Twenty-seven telephones were also sold. This cleans up everything belonging to the company, and all its property in Ypsilanti is in the name of B. B. Hazelton.

In the new Western Union telegraph office at Evansville, Ind., is a telephone closet. At the sides of the telephone are a number of pigeon-holes; these are for the telegrams which are telephoned instead of delivered by messenger. A large number of firms in the surrounding towns have their telegrams delivered in this way. As the telephone box is "sound-tight" the bell cannot be heard when the Western Union is called. By an ingenious device of W. E. Duke, the manager at that point, a telephone switchboard drop was so adapted that whenever the telephone bell rings the drop falls, ringing a loud bell in the front of the office. This bell continues to ring until the telephone is answered.

## TELEGRAPH.

The new offices of the Postal Telegraph company in Fittsburg, just opened for business, are very handsome and complete. They cover 5,000 feet of floor space. The floor is of marble and the wainscoting of green granite. Pneumatic tubes extend from the delivery department in the rear of the building to the receiving department in the front. The operating room has accommodations for over 100 operators.

## POWER TRANSMISSION.

A good idea may be gathered of the extent to which the transmission of power by electricity is gaining ground in this country by the statement that in the long-distance plants installed by the General Electric company during 1895 over 1,200 miles of copper wire for transmission purposes alone was used, amounting practically to 1,000,000 pounds of copper.

William A. Chapman & Co., Providence, R. I., have been awarded the contract to erect the power house in Columbia, S. C., for the Columbia Water Power company. The power house is built for the purpose of developing all of the remaining water power in the present Columbia canal, which is approximately 10,000 horse power. The water power will be converted into electricity. Power will be sold and the contract has been made for power to run a large cotton mill, located about a mile from the canal. The power house is but a short distance from the one built on the same canal about two years ago, and power from this is utilized to run a large duck mill of the Columbia mills. The house will be about 184 feet long by 30 feet wide, besides forebay and tail-race.

## MISCELLANEOUS.

*Compressed Air*, "a monthly publication devoted to the useful application of compressed air," has made its appearance in New York. It is attractive in appearance and bids fair to be a worthy representative of a growing industry. Its publication is another evidence of the tendency toward specialization in modern technical journalism.

Brazil, Uruguay and the Argentine Republic have extended invitation through the State Department to the chambers of commerce and other trade organizations in this country to visit those three countries this year for the purpose of becoming familiar with their resources. The object of the trip is to show to representative men of the United States the opportunities offered in these markets for American trade.

A judgment for $3,745 has been rendered against the World's Fair company in the Federal court in Chicago in favor of the Yale-Towne Manufacturing company. The later company installed an electric traveling crane and other machinery in machinery hall and sued for $25,000 on the contract. The World's Fair people insisted that they had to expend the money held back to put the machinery in working order.

James Moran has brought suit for $15,000 against the Corliss Steam Engine company of Providence, R. I., for injuries caused by a shock received from an electric crane in the foundry of that company on February 6th last. It happened the same day that William Houghton received a fatal shock. The crane is a large iron structure fitted with a switchboard, and both men at different times have received slight shocks while working on the crane. On account of wet weather the day on which Moran was injured several of the men received heavy shocks, Moran's being severe. Soon after this Houghton was killed.

## TRADE NEWS.

A new pamphlet issued by the Electric Storage Battery company of Philadelphia shows the varied uses to which the accumulator can be put. Much general information about storage batteries is given, with a list of plants and directions for setting up and use. Anyone contemplating the use of chloride accumulators will find this compilation of great value. The Chicago office of the company is at 1543 Marquette building.

One of the largest orders for a telephone cable given out for some time was secured by the National Underground Cable company of New York, for the telephone cable for the city of Toledo. The contract calls for a full completion of the work, in laying, jointing, and connecting the cables. This company is making a decisive push also for work for electric light and street railway cables, and is about to increase the departments and include one for the manufacture of telegraph cables. General Manager James P. McQuaid is showing his oldtime push in placing this company so soon in the front rank.

The Diehl Manufacturing company of Elizabethport, N. J., has recently issued a supplementary catalogue illustrating its numerous styles of ceiling, electrolier, column, counter and propeller fans. The catalogue is profusely illustrated, showing the products in a manner which anyone in the trade can easily understand. It also includes full directions for putting up the Diehl electric ceiling fans. This catalogue should be in the hands of everyone needing anything in this line.

The Lacombe carbon has been used long enough in this country to have a good reputation. The Arc Light Supply company of Elizabeth, N. J., has been appointed sole agent for the United States. This concern has issued a new price list of these goods which has resulted in a large increase in business. This carbon is the result of careful and exhaustive tests. It gives a steady, brilliant light, and is said to be absolutely uniform in consumption. The packages are sold only in the original form received from abroad, with the French labels, and the company guarantees that every order will be delivered in this way.

The E. G. Barnard company of Troy, N. Y., has recently been obliged to extend its manufacturing facilities in order to meet the large growth of its business. The dynamos and motors manufactured by this concern are of excellent construction. The magnetic field is made of one piece of forged iron, and a high grade of efficiency is claimed for it. The company reports a large sale for the Powers arc cut-out, which is especially manufactured to meet severe conditions. The Barnard company is extending its business rapidly and is now preparing a number of specialties which will soon be placed on the market.

The Viaduct Manufacturing company of Baltimore, Md., is presenting patrons a fine map of the state in which the applicant may happen to reside. It is correct in detail, and as a consequence there is a great demand for copies, which will soon deplete the supply. This concern is having a large call for telephones and magneto signal bells. The company also manufactures district messenger call boxes, which can be used in large factories or places where this class of signal work is desired. The new factory located at Relay, Md., is working over time in order to keep abreast with the large orders which have been placed with this concern since the first of the year. President A. G. Davis, who has been identified with the Viaduct company for so many years, also acts as general manager, and under his careful management the concern has grown from a business which was at first mainly local to its present large proportions.

The Mica Insulator company, sole manufacturer of micanite, 218 Water street, New York, with factories at Schenectady, N. Y., and London, England, is sending to the trade a large sample card, handsomely gotten up, showing samples of micanite commutator segments, rings and slot insulation, for the standard railway motors and power generators. Micanite and Empire insulating cloth and paper are shown in nine different grades, which are used largely for insulating armature cores and fields. The lower part of the card is given up to the list of agencies in the principal cities, where stock is carried: Chicago, W. H. Sills & Co.; St. Louis, A. S. Partridge; Cincinnati, Sinclair Randall; Cleveland, the Cuyahoga Supply company; San Francisco, J. W. Brooks & Co. On the back of the card appears a description of the different lines of insulation that the company manufactures. The company is enjoying an excellent trade on its micanite, which has become known as the standard insulation, both in this country and in Europe.

## BUSINESS.

The Connecticut River Manufacturing company, Holyoke, Mass., has purchased a 40 horse power Ball engine for electric lighting from J. H. Houghton, Boston representative of the Ball Engine company, Erie, Pa.

The Electric Appliance company is distributing two catalogues, which should be in the catalogue library of every electric light station in the country. One of these is a catalogue of Paiste specialties and the other of P. & S. porcelain specialties. Both of these catalogues are supplied with special trade discount sheets giving the latest and lowest trade prices on these goods. Copies are sent on application.

W. C. Sterling & Son of Monroe, Mich., dealers in cedar poles for supporting overhead wires, carry a large stock of poles of all lengths up to 60 feet at their Northern and Monroe yards, and are always prepared to fill orders on short notice. The Monroe yard, being located between Detroit and Toledo, has excellent transportation facilities. The poles are shaved, housed and painted with one or two coats when wanted.

Eugene Munsell & Co., 218 Water street, New York, importers and wholesale dealers in India and amber mica, are sending to the trade a large sample card showing a variety of forms of mica for electrical insulation, stamped solid mica segments for all the standard railway motors, mica washers, etc. At the top of the card appears the company's name and address, in heavy bold type, as importers of pure India mica for electrical insulation, and the statement that the mica can be furnished in amber quality. The lower part of the card is given up to the list of agencies in the principal cities: Chicago, W. H. Sills & Co.; St. Louis, A. S. Partridge; Cincinnati, Sinclair Randall; Cleveland, the Cuyahoga Supply company; San Francisco, J. W. Brooks & Co. This card has been sent to the manufacturers of electrical machinery, electric repair companies and electric street railways in the United States, and is highly appreciated by the electrical trade in general.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

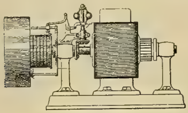
*Issued March 17, 1896.*

556,342. Electric Motor Rheostat. Thomas J. Fay, New York, N. Y. Application filed December 12, 1895

A rheostat frame containing a rheostat is mounted upon a rotary shaft, and there are a series of contacting rings suitably insulated from each other and mounted upon the same shaft, and forming the terminals respectively of the various sections of the rheostat, a brush constantly in contact with one of the rings, an adjustable brush adapted to make contact with any of the rings, and means for moving the adjustable brush.

556,359. System of Multiphase Distribution. Ralph D. Mershon, Pittsburg, Pa. Application filed April 11, 1895.

The inventor claims the combination with a multiphase system of distribution having a given number of main conductors, of electric converters having their primary terminals connected with the main line circuits and a greater number of terminals derived from their secondary circuits than the number of main conductors, a rotary transformer having a single armature winding, and connections from the respective secondary terminals with corresponding points of the armature winding of the rotary transformer.



NO. 556,342.

556,362. Electrical Connector for Arc Lights. John J. McGill, Thorold, Canada. Application filed January 15, 1896.

In this device the combination is claimed with the insulator of a ball-and-socket metal connection between the end of the loop line wire leading to the lamp, and the wire carried by the insulator leading from the line.

556,386. Electrical Gas Cook. Harry L. Tyler, Corning, N. Y. Application filed June 20, 1895.

The casing has an inlet gas passage; a valve is arranged to cover and uncover the passage, and opposite exteriorly arranged electro-magnets are employed, the cores of which are detachably fitted in opposite sides of the casing in line with the valve.

556,408. Rheostat. Thomas J. Fay, Brooklyn, N. Y. Application filed December 19, 1895.

A controlling lever, an electro-magnet, the lever being pivoted to one of the poles of the magnet, a spring arranged to swing the lever on its pivot, the magnet being included in two circuits adapted to oppositely magnetize its core.

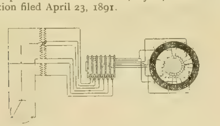
556,414. Electric Hub Welding Machine. Charles E. Harthan, Lynn, Mass. Application filed June 20, 1891

One claim is given: The combination in an electric metal-working apparatus of a transformer, a work electrode connected to one terminal of the transformer, a circuit making and breaking contact carried by the other terminal thereof, an opposite work electrode movable to and from the first, and a circuit making and breaking contact carried thereby and adapted to engage with the corresponding contact connected to the other terminal of the transformer.

556,425. Electrical Registering Instrument. Hermann Lemp, Lynn, Mass. Application filed March 12, 1891.

An actuating electro-magnet is employed, having an iron core and coil related so that the iron of the core will saturate with a very small fraction of the maximum current employed in operating the register.

556,426. Electric Metal Working Apparatus. Hermann Lemp and Warren B. Lewis, Lynn, Mass. Application filed April 23, 1891.



NO. 556,359

A work-holder is connected to a source of heating electric currents two or more separate work-holders common to the first and provided with means whereby they may be moved toward it are also employed, and independent automatic cut-off devices controlled by the movement of the several parts of the work independently of one another, whereby the flow of current in each may be cut off or decreased independently of the others.

556,425. Electric Program Clock. John P. Luxmore, Chicago, Ill. Application filed November 14, 1894.

Claim one is given: The combination in an electrical recorder of a clock with a time-indicating dial and a clock mechanism, a contact arm revolved thereby, a series of contact points in the path of said contact arm, a series of contact strips each provided with a series of holes corresponding to the hours and fractions thereof of a day, conductors leading from the contact points close to such holes, means for connecting the strip and conductor at such holes, a revoluble disk having a surface of non-conducting material, a conducting section on such surface, a series of contacts arranged circumferentially around such disk and connected to such contact strips, the conducting section of the disk being adapted to be successively brought into contact with the contacts arranged thereabout as the disk is revolved.

556,435. Electric Elevator. John Parkinson, Thomas M. Martin and Calvin C. Bowen, Los Angeles, Cal. Application filed February 7, 1895.

The combination of the four standards, each having on the outer sides paired racks formed with stepped teeth and flanges on both sides of the paired racks, the traveling frame, the driven shafts journaled to the traveling frame, the paired pinions formed with stepped teeth, and with flanges bearing against the flanges of the standards, the worm wheels secured to the driven shafts, the motor and the motor shaft having worm gears and arranged transversely of the driven shaft.

556,437. Electric Arc Lamp. George C. Pyle, Indianapolis, Ind. Application filed May 2, 1895.

Features of the invention are: A suitable holding-bar mounted parallel with the upper electrode, a spring-controlled clamp for grasping the upper end of the electrode and slidably mounted on the holding-bar, and an arm extending from the holding-bar, and having on its end a ring with a series of inwardly and downwardly extended fingers or claws to hold and support the electrode at its lower tapering end.

556,479. Electric Arc Lamp. Thomas Spencer, Philadelphia, Pa. Application filed July 1, 1895.

A frictional feed regulator, a magnet controlling the same and regulating the length of the arc, and an independent stopping device for limiting the extent of slip of the friction mechanism.

556,488. Motor Suspension. Norman C. Bassett, Lynn, Mass. Application filed November 27, 1895.

This arrangement comprises a truck frame, a wheeled axle mounted in the frame, a motor geared to the axle, and a support for the other end of the motor consisting of a bar or yoke so bent as to be supported upon the truck frame at substantially the plane of the center of gravity of the motor.

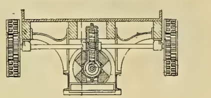
556,496. Telephone. Cleaveland F. Dunderdale, Chicago, Ill. Application filed May 24, 1895.

The inventor claims a diaphragm constituting one electrode, a back piece in proximity to the diaphragm, a conducting body or conducting bodies disposed between the electrodes, and a mass or quantity of comminuted or granulated conducting material surrounding the conducting bodies.

556,502. Electric Drill. Max Hebgen, Butte, Mont. Application filed July 16, 1895.

In an electrically operated rock drill the combination is claimed with a hollow armature and shaft of a water-tight casing which constitutes the field magnet of the motor, a hollow drill-operating shaft to rotate with and move longitudinally in the hollow armature shaft, positive mechanism for feeding the hollow drill-operating shaft, and a manually operated lever for interrupting and controlling the feed movement.

556,510. Electric Switch. Norman Marshall, Boston, Mass. Application filed December 14, 1895.



NO. 556,435.

Special features enumerated include a pivoted contact member movable in opposite directions, and provided with teeth, holding-pawls co-operating with the teeth, a pivoted actuating plate or bar movable in opposite directions and adapted to disengage the holding-pawls from the movable contact member, a spring placed under tension by the movement of the actuating plate or bar, and acting on the movable contact member to turn the same on its pivot in the same direction as that in which the actuating bar is moved.

556,516. Electric Railway System. Byron E. Osborn, Auburn, N. Y. Application filed September 3, 1895.

A casing or conduit is provided with pockets or chambers extending inwardly from one of its longitudinal faces and formed of less height and length than the thickness and width of the casing or conduit; a line conductor is arranged in the casing or conduit and passed through the pockets or chambers, and supports movable in the pockets or chambers toward and away from the line conductor, and provided with means for engaging the conductor, are provided.

556,524. Electric Heater. James E. Williamson, Charles E. Collins and John B. Graham, Allegheny, Pa. Application filed February 9, 1894.

The heater is applied to oil wells, and consists of the perforated shell, screw caps, positive insulated conductor terminal, negative insulated conductor terminal, and tube with bell mouth.

556,544. Battery Connection. Milton M. Kohn, Chicago, Ill. Application filed July 29, 1895.

The first claim is reproduced: The combination with a metallic cup of a battery cell provided with a metallic casing connected with one pole of the battery, the end of said casing being adapted to fit into said cup to complete electrical connection therewith, and to be supported in position thereby, a terminal provided upon the opposite end of said battery insulated from said casing and connected with the opposite pole of the battery, and contact springs adapted to grasp said terminal, said contact springs and said metallic cup forming the terminals of an electric circuit, whereby the battery may be placed in position by a simple movement and without the intervention of binding parts necessitating screwing or other manipulation.

556,553. Railroad Crossing Signal. Richard O'Toole, Thurmont, Md. Application filed February 20, 1895.

In a railroad crossing signal the combination is claimed of a track and a pair of track bars located beside the track, one in front of the other, with a pair of electro-magnets and a pair of circuit closers, the circuit closers being so constructed as to open, except when closed by a weight, mechanism connecting the armature of the magnets with the weights of the circuit closers for lifting the weights when the magnets are energized, and means for automatically suspending the weights during a specified period after having been raised.

556,602. Underground Conductor for Electric Railways. George Westinghouse, Jr., Pittsburg, Pa. Application filed January 6, 1804.

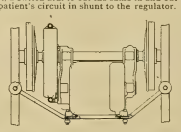
A conductor for electric railways composed of two like halves fastened together by means of conducting devices, and having adjacent contact faces separated by a clear space.

556,609. Telephone Switchboard. Isaac Anderson, Saginaw, Mich. Application filed July 8, 1895.

An electro-magnet, the core of which is included in the circuit of a telephone, a working battery in circuit with the magnet, the zinc element of the battery having a ground connection, a circuit-closing device included in the line of the circuit connections for the battery, a circuit-closing roller having a contact core circuited with the circuit-closing device, a movable armature for the magnet having a pawl connection with the roller to partially rotate the same, a suitably suitably supported circuit-closing lever normally resting against the core of the circuit roller, and a main line branch wire having a circuit connection with the armature, and also with the circuit-closing roller.

556,617. Electro-therapeutic Apparatus. William Carter, Louisville, Ky. Application filed January 29, 1896.

Included in the arrangement are a motor-generator, a circuit for a direct and a circuit for an alternating current, a regulator in each circuit consisting of a series of resistances, a switch arm to cut the same in and out, and a lesser series of resistances differentiated from but connected with the first, a switch arm to cut the same in and out of circuit, and a patient's circuit in shunt to the regulator.



NO. 556,488.

556,626. Electric Furnace. Adam C. Girard and Ernest A. G. Street, Paris, France. Application filed May 24, 1895.

The combination in an electric furnace is claimed, of a heating chamber, a longitudinal passageway extending through the chamber, a tubular cylinder for containing the material to be heated, means for feeding the cylinder through the longitudinal passageway, an electrode projecting into the heating chamber, suitable terminals, and electric conductors connected with the terminals for enabling a voltaic arc to be produced between the electrode and the cylinder.

556,646. Device for Detecting Short-circuits. Charles F. Scott, Pittsburg, and Charles E. Skinner, Allegheny, Pa. Application filed December 31, 1892.

The method of detecting the presence of a closed circuit in a given coil or coils among a number of coils consists in bringing the coil or coils in magnetizing relation to a second coil carrying a fluctuating current and determining whether or not it acts to alter the counter-electromotive force of such second coil.

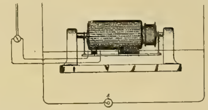
556,654. Electric Locomotive. Thomas E. Adams, Cleveland, Ohio. Application filed September 5, 1894.

One claim is for the combination with a truck frame and an axle of a motor geared at both ends with the axle, flexible connections between the motor and truck frame, centrally between the ends of the motor at both sides thereof, and gear casings connecting the motor and axle.

556,660. Secondary Voltaic Battery. William A. B. Buckland, London, England. Application filed July 15, 1895.

Claim one follows: A perforated plate for a secondary voltaic battery having slots, and provided with a surrounding frame, a plurality of T-shaped sections arranged at opposite sides of the plate, and having their projecting parts engaging the said slots to form a plurality of compartments at each side of the plate, which are charged with active material, the material in the compartments at one side of the plate communicating with the material in the compartments at the opposite side of the plate through the perforations in said plate, and said active material being held in place by the surrounding frame and by the said T-shaped sections.

556,670. Block Signal Telegraph. Claude M. Grace, Philadelphia, Pa. Application filed September 10, 1895.



NO. 556,646.

A telegraph system is employed, consisting of a suitably charged feed-wire, a number of stations connected in multiple to the feed-wire through suitable resistances, each station provided with a loop of a line wire, two sounders, one on each side of the loop, two two-pointed keys normally completing the loop through a bridge wire, a switch having its arm connected with the bridge wire, and one of its points grounded, a single pointed normally open key connected to another point of the switch, and conductors connecting the normally open contact points of the three keys to the feed wire.

556,693. Electric Lamp. Charles E. Quimby, New York, N. Y. Application filed August 18, 1893.

As an improved article of manufacture, an incandescent electric lamp is described, formed of an annular glass globe, an annular illuminating conductor, a metallic shield inclosing one-half of the lamp and extending through the central aperture of the lamp beyond the plane of the annular illuminating conductor, and a heat insulating backing applied to the metallic shield.

556,718. Electrical Apparatus for Drilling Wells, Tunnels, etc. Phillip Semmer, Irwin, Pa. Application filed August 16, 1895.

This is an apparatus for drilling wells, consisting of a casing, a motor located in the casing, a suitable cutting device operated by the motor, a tube leading into the casing and having an outlet therein, the tube adapted to inject air under pressure into the casing.

Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, APRIL 4, 1896. No. 14

## Simple but Effective Electric Fountain.

In the large department store of Siegel, Cooper & Co. in Chicago the central feature of the main floor is the attractive electric fountain which is herewith illustrated. Conspicuously simple in construction, this fountain nevertheless gives a very satisfactory effect, although it is continuously operated in the daytime and is surrounded by a number of arc and incandescent lights. It excites expressions of admiration from the patrons of the store and is generally surrounded by a number of admiring spectators. It is one of the few indoor electric fountains in the United States, and is further distinguished by the fact that the light is reflected into the water-jets from above instead of from below the fountain basin.

FIG. 1. SIMPLE BUT EFFECTIVE ELECTRIC FOUNTAIN.—A PLEASING DEPARTMENT STORE ATTRACTION.

The fountain proper consists of a large number of jets—about 300 in all—which rise in the center to a height of 18 feet from a shallow circular basin, set in concrete, 20 feet in diameter. These jets issue from a corresponding number of nozzles in concentrically arranged rings of brass pipe placed in the center of the basin. The pipe is three-fourths inch in diameter and the rings range from one foot to six feet in diameter. The water is obtained from an artesian well on the premises which is said to be 2,000 feet deep. It is first pumped up to a surface tank and then farther elevated to tanks on the roof by powerful pumps. From the latter tanks a gravity pressure of 65 pounds to the inch is obtained at the fountain. After being aerated and serving an ornamental purpose in the fountain, the water is again returned to the elaborate waterworks system of the establishment and is used for drinking purposes in the water-coolers. One of the principal hydraulic features of the fountain is a water-regulating and air-collecting device consisting, essentially, of two reservoir tanks connected with the main supply pipe and with each other. By means of a siphon effect a partial vacuum is maintained in the tanks. The arrangement is such that particles of air in the main header are trapped into this space. This prevents the jets blowing air and fluctuating, and the air cushion also aids in maintaining a uniform pressure. The various jet rings are separately controlled by valves in the operator's box, shown at the left and beyond the fountain in Fig. 1, and a considerable variation in the water design is obtainable.

As shown by the diagram of the leading features, Fig. 2, the electrical operation is simplicity itself. A box four feet square and one foot deep is attached to the ceiling directly over the central jet of the fountain, as may be seen in Fig. 1. It is 2½ feet above the highest point reached by the water. This box is divided by the horizontal partition *A B* (Fig. 2), upon which is placed a 4,000 candle power Meissner focusing lamp *L*, mounted on the slate base *C D*, in which is cut the circular opening *E F*. This lamp takes 30 amperes at 70 volts, and is operated, with the interposition of resistance, on the 110 volt house circuit. Above the horizontally disposed carbons is a quadruple silver-plated reflector *K*, which throws the light through the opening *E F*, the glass screen *G G'* and the hole in the bottom of the box *I J*, into the water of the fountain below. The reflector is attached to the base *C D* by four rods, which are constructed in such a manner that the focus may be easily adjusted. The light is colored by passing through the glass screens in the revolving disk *G H*, which is turned horizontally by the one-eighth horse power motor *M* through chain, cog and worm gearing, as shown. The revolving disk has six glass screens—five colored and one clear—each eight inches in diameter, corresponding to the diameter of the lower aperture. The reflected light of the lamp is estimated to be equivalent to 2,000,000 candle power. It is so powerful that, in spite of the illumination of six immediately adjacent arc lamps of 2,000 candle power each, many incandescent lights and the daylight from the street windows, the colored water

shows almost as brightly at noon as at night. The switches for controlling the lamp, motor and resistance are placed in the operator's box, and from this point all the electrical and hydraulic effects are manipulated.

This electrical fountain has a history. It was originally constructed for theatrical purposes by L. Flory and N. R. Mariotte after the modified plans of a French nobleman who, in the course of a checkered career in America, made his home in Chicago for a period. It was changed to some extent to conform to its present environment, and the electrical devices were installed by E. C. Bennett. The operator for Siegel, Cooper & Co. is F. A. Aldrich. The fountain has been in operation a little over two months.

## The Surgical Value of the X-ray.[1]

By James Burry, M. D.

I will consider Röntgen's ray only from the surgeon's point of view. When Professor Röntgen announced he had secured pictures of the bones when surrounded with natural and living tissues, he aroused the interest of the entire world, particularly the medical world.

It is difficult for anyone not a surgeon to appreciate the importance of securing outlines of deeply embedded bones or foreign bodies. In the vicinity of joints fractures can only, with considerable difficulty and painstaking measurements, be discovered or differentiated from dislocations, and where both exist it is impossible at times to locate both—one or the other may be overlooked. Take, for instance, the thigh bone near its articulation with the hip bone. This joint is covered with large and powerful muscles and thick layers of tissue, so that it is difficult to outline the bones. Fractures and dislocations in this vicinity are diagnosed and differentiated largely by symptoms, such as the position of the leg and foot, the difference in length of the leg from its fellow. These and other means are those ordinarily employed by the surgeon. Given a fracture two or three inches from the head of the thighbone, who can tell whether the upper short fragment of bone is broken into one or several pieces? In childhood, injuries to the epiphyseal heads of bones frequently occur, and the exact nature of the injury is difficult to diagnose. Again, one of the most frequent of surgical diseases is tuberculosis affecting bones. This disease, which is more popularly known as consumption, frequently is incapable of detection until gross lesions or changes present themselves. Some idea of the prevalance of tuberculosis may be had when it is known that one person out of every seven dies from its ravages. Next to the lungs the bones are the tissues most frequently invaded by this disease. It is also true that general constitutional symptoms form no certain index of the presence of this disease in the bones. Exploratory operations are generally needed to form a diagnosis.

What is true of tuberculosis is also true of other malignant diseases, such as sarcoma or cancer. If their location happens to be in the medullary cavities of bones, no diagnosis can be made positively without exploratory operations. Abnormal growths on bones near joints are sometimes located by ordinary diagnostic means with great difficulty. Foreign bodies are difficult of detection when deeply imbedded in tissues, from their small size or from being enclosed in a dense structure. In the ducts leading from the large organs of the body are frequently found calcareous formations which can only be imperfectly determined by subjective symptoms.

All of these conditions have been definitely disclosed by means of the Röntgen pictures, and, with the exception of two, have been shown by pictures taken by Mr. C. E. Scribner and myself. We have shown tuberculosis in the wrist-joint of a child, the location of a sarcoma commencing in the marrow cavity of the thighbone of an adult, fractures and exostoses of the bones of the leg, arm and hand, dislocation of joints, and have removed foreign bodies after their location by means of the X-ray, in the living subject. I may be pardoned for referring in detail to the location of a shot in the hand, as the removal of this body was the first surgical operation performed in this country when the diagnosis had been made by a Röntgen picture.

In the case of the sarcoma of the femur, a diagnosis could be made by inference only. No swelling or other changes in the soft tissues surrounding the bone could be found, but a picture taken February 24th last showed clearly this malignant growth in the center of, and confined to, the bone. This picture distinguished clearly the fat from the muscles. An operation made three days later showed the accuracy of the picture. So far as I am aware, this was the first case of a central bony tumor being diagnosed by means of the X-ray. When it is known that patients afflicted with these central bony tumors are not infrequently treated for months for neuralgia or rheumatism, some idea of the value of this aid to diagnosis may be had, especially when it is remembered that every day the disease is unrecognized increases the chances of the transmission of the disease to other parts of the body, thereby endangering the life of the patent.

In one case a picture of a hand was taken which showed clearly the presence of a part of a fine cambric needle lying adjacent to the inner side of the long bone of the hand corresponding to the thumb. This part of a needle was not quite one-half inch in length, and several unsuccessful attempts had been made by surgeons to remove it. With the picture as a guide, it was successfully removed; and, as it had been in the hand over five years, occasioning a great deal of pain and the loss of use of the hand, its removal firmly fixed in the mind of this particular patient the value of the Röntgen ray.

However, it is not alone in diseases of the bones and the presence of foreign bodies in tissues that this agency will be of use. When it is possible to control the rays, securing greater or lesser intensity, as may be desired, it is not beyond the range of possibility that many diseases of the soft tissues may be recognized. For instance, in valvular diseases of the heart it may be possible to recognize some forms of lesion. Calcareous formations sometimes occur in the lungs or other organs, and these should be susceptible of definition. Some of the grosser inflammatory alterations in tissues may be recognizable. Renal and biliary calculi should be disclosed upon proper exposure to the ray.

The range of use of this ray, however, may be easily over-estimated. It should not be forgotten that many of our most serious difficulties have their origin in changes so minute as to escape an inspection of the tissues made with the naked eye, and it is only when properly prepared and brought into the field of a microscope of great power that many changes in tissues, serious in their results, can be detected. For instance, take a paralysis affecting the muscles of the arm; that part of the spinal cord in which the nerves furnishing motive power to these muscles originate is the cervical part of the spinal cord, and should give a good picture; but how could we expect to obtain any assistance in the diagnosis from this picture when, if the spinal cord itself was laid before us, no examination made by the naked eye would disclose the slight inflammatory changes that produced the disastrous results causing the loss of use of the arm? It is, therefore, difficult to imagine that any improvement in the methods of taking these pictures would ever disclose the differences if so minute as to require the use of a microscope for their detection. No photographic print on paper gives an idea of the full value of this process. The negative is always more distinct than any print. The several improvements which have been described and shown to you this evening in the taking of these pictures will add greatly to their surgical value.

Many substances are shown by former experimenters in this field to have the property of fluorescence, or illumination, under the influence of this ray. Taking advantage of this, fluorescent screens have been prepared. I understand that to Professor Salvioni of Perugia, Italy, is to be given the credit of first combining this screen with a tube, in one end of which was the screen and in the other a lens, thereby getting instantaneous and clear shadows.

I believe that with the improvements already made, and that will be made, by electricians in the production and control of the X-ray, surgery will find in the process a most valuable aid in diagnoses, and mankind will be correspondingly benefited.

1. Read before the American Institute of Electrical Engineers, Chicago, March [illegible], 1896.

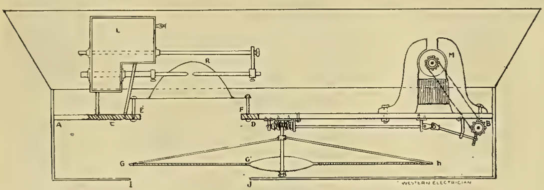



FIG. 2. SIMPLE BUT EFFECTIVE ELECTRIC FOUNTAIN.—SECTION THROUGH CEILING BOX.

## Chicago Electrical Association.

Papers announced to be read before the Chicago Electrical association at 1737 Monadnock block are as follows: April 3d, "The Commercial Testing of Iron and Steel," by W. K. Howe; April 17th, "Little Economies in Central Station Practice," by Thos. G. Grier; May 1st, "Problems in Electric Elevator Work," by H. Cochrane; May 15th, "Electric Heating," by Edward Puchta. The society will enjoy a banquet on May 29th.

## On the Source of the Röntgen Ray.

By W. M. Stine.

A series of experiments extending over the last six weeks has at length yielded conclusive evidence and enabled the source and distribution of the ray to be mapped out around the entire tube with great clearness. Penumbral shadows were repeatedly plotted back to the tube and invariably pointed to the area of the bulb opposite the cathode as the source of the distribution. These observations have already been published.[1] It

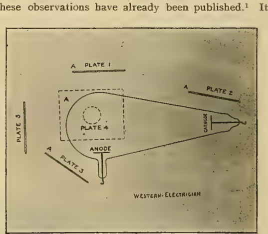



FIG. 1. ON THE SOURCE OF THE RÖNTGEN RAY.

occurred to the writer that the best means to trace the ray distribution would be shadows cast by short metallic tubes. Half-inch lengths were cut from No. 18 gauge brass tubing, varying in diameter from one-half inch to three inches. In the first experiment these were placed concentrically on a dry plate and placed parallel with the bulb in position marked 5 in Fig. 1, the distance of the plate from the bulb being four inches. The sciagraph is reproduced in Fig. 2. Two separate effects are to be noted in all the sciagraphs of the tubes used. Both the length and direction of the shadow are clearly indicated and the vertical shadow of the metal itself. It will be noted that the latter seems to indicate the presence of rays which are more or less vertical. Plotting the shadows in Fig. 2, and noting that the vertical shadow does not appear beyond the third ring, we find that the source of the rays was on the surface of the bulb, and the area of the source was nearly or quite circular, and not much in excess of the diameter of the third ring, which was 1½ inches. With such a clear and unmistakable result in possession, the next experiment was an attempt to decide whether this area was the only source of the ray. We were guided in this by some recently published emphatic statements that the ray was of anodic origin and did not, as popularly supposed, proceed from the cathode. It was seen that while a screen could be misleading, the shadows cast by rings would be conclusive. Four plates were prepared for simultaneous exposure. The concentric rings

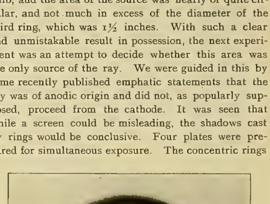



FIG. 2. ON THE SOURCE OF THE RÖNTGEN RAY.

were placed on one plate and single rings of one inch diameter and the same height were placed over the other plates. All these objects were placed as nearly as possible on the center of the plates. In Fig. 1 is shown the shape of the tube, the position of the electrodes and the plates, which were the 3¼ inch by 4¼ inch size and placed 2½ inches from the bulb. The plates were marked with the letter A on the ends, which were disposed as shown in the drawing. The resulting scia-

1. Western Electrician, March 7, p. 110. *Electrical Engineer*, March 11, p. 225.

graph from plate 1 is shown in Fig. 3, that from plate 2 in Fig. 4, from plate 3 in Fig. 5 and from plate 4 in Fig 6.

To interpret the results, note first the sciagraphic effect of the rings, and, second, the elliptical shadows of the intercepted inclined rays. If the latter be plotted, they all point to one area, the circular cathode imprint on the end of the bulb. We may now call this the prime source of the Röntgen ray. The vertical ring shadows, however, indicate numerous secondary and more or less weak sources. A general statement can then be made to the effect that about the entire surface of the tube is sciagraphically active. The four plates were developed together for an equal length of time. Plates 1 and 3 developed soonest, 4 a little slower, and the image on 2 was the last to appear. The resulting negatives are, however, all excellent and of about equal density. It is thus shown that a number of sciagraphs may be taken simultaneously if the entire tube be surrounded by plates. It might be added that the rings in Fig. 3 were held in concentric position with wedges of pine wood one-half inch thick, and since these do not show, they were entirely transparent for this length of exposure.

The sciagraph shown in Fig. 3 is now, perhaps, the most interesting one of the series. It was purposely placed exactly opposite the anode. If the anode were the source of the ray, the resulting sciagraph would have resembled the one shown in Fig. 2; all the shadows would have been concentric rather than elliptical. The result plainly shows that the cathode, not the anode, is the source of the X-ray. The polarity was determined by testing the charges on the poles by means of an electroscope. In Fig. 5 (plate 3) the shadow points only in one direction, and since the ring was near the anode, it would have shown a shadow on the opposite side had the anode been active. Fig. 4 (plate 2) shows another

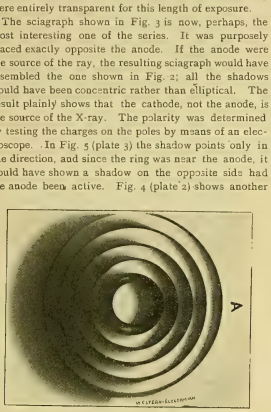



FIG. 3. ON THE SOURCE OF THE RÖNTGEN RAY.

striking result. The shadow is seen to broaden as it extends from the ring. This indicates that the rays crossed between the source and the object. The explanation is at once apparent. The rays were, in a sense, focused by the concave surface of the interior of the bulb, but it must not be concluded that the Röntgen ray has thus been actually focused.

If Figs. 3, 5 and 6 be carefully examined, the vertical shadows will be seen to be quite distinct, and Fig. 4 shows the same result less strongly marked. These phenomena are closely associated with the fluorescent appearance of the tube, which is decreasingly marked toward the space around the cathode.

The entire experiment here described has been carefully repeated, to avoid error. To summarize, it shows that there is but one marked source of the ray, that portion of the bulb opposite the cathode, and that the entire surface of the bulb is more or less a weak secondary source; that it is the cathode, and not the anode, which produces the rays. The only question which now remains is whether it is the interior or exterior of the tube that is active. There are many reasons which point to the interior surface. Another tube has just been designed to test this point. However, it would seem that the active surface would be that struck by the charged molecules. These experiments have been largely directed by the electrolytic theory of the production of the sciagraph which has been advanced by the writer.

The tube used in these tests was one especially designed to promote electrical exhaustion. The writer has advanced the opinion that this was accomplished by the occlusion of the gas by the anode. The vacuum of the tube was too low to produce the sciagraph when first tested, but after being excited for about 10 hours became quite active. If, however, the current is reversed, the tube immediately fills with the purple light at first present. This seems quite conclusive evidence and further shows that no material particles are projected through the walls of the tube.

## Röntgen's Discovery Discussed at the Chicago Meeting of the A. I. E. E.

On Wednesday evening of last week a meeting of the Chicago members of the American Institute of Electrical Engineers was held at Armour Institute of Technology. About 200 members and visitors, including many ladies, were present, and much interest was manifested in the

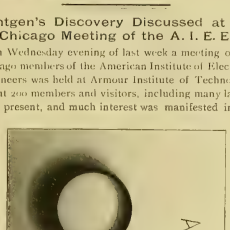



FIG. 5. ON THE SOURCE OF THE RÖNTGEN RAY.

proceedings. Angus S. Hibbard, vice-president of the Institute, presided at the meeting, and W. M. Stine, local honorary secretary, announced that the topic of discussion for the evening's session would be Röntgen's discovery and experiments with X-rays. C. E. Scribner of the Western Electric company read the first paper and illustrated his experiments by means of lantern slides. Dr. James Burry of Chicago, who has the distinction of being the first surgeon in the United States to apply the X-rays to the practice of his profession, presented an interesting paper on the practical application of the discovery to surgery and medicine. Professor Stine gave a short lecture on the experimental work conducted at Armour Institute under his supervision and showed some very interesting sciagraphs. Several Crookes tubes were displayed and their action explained. A Geissler tube was also exhibited.

At the conclusion of the formal presentation of papers an opportunity was afforded visitors to examine the apparatus employed in these experiments. An interesting discussion of the papers followed and a vote of thanks was extended to the gentlemen who contributed to the success of the meeting. The gathering was undoubtedly the largest that has ever been held in this city under the auspices of the Institute, and it is believed that the interest awakened will do much to stimulate the work of the local branch.

## American Institute of Electrical Engineers.

At the monthly meeting of the council on March 25th the returns of nominations were canvassed, and the following named council nominees were selected:

For president, Louis Duncan of Baltimore.

FIG. 6. ON THE SOURCE OF THE RÖNTGEN RAY.

For vice-presidents, Charles P. Steinmetz of Schenectady, Harris J. Ryan of Ithaca and W. M. Stine of Chicago.

For managers, J. W. Lieb, Jr., of New York, F. A. Pickernell of New York, William L. Puffer of Boston and L. B. Stillwell of Pittsburg.

For treasurer, George A. Hamilton of New York.

For secretary, Ralph W. Pope of New York.

The terms of the following named officers do not expire this year: Vice-presidents, Angus S. Hibbard of Chicago, Dr. M. I. Pupin of New York and W. F. C. Hasson of San Francisco; managers, A. E. Kennelly of Philadelphia, C. S. Bradley of Baltimore, W. D. Weaver of New York, W. B. Vansize of New York, Charles F. Scott of Pittsburg, Carl Hering of Philadelphia, Cary T. Hutchinson of New York, and H. J. Arnold of Chicago.

The rules have been amended by the council under advice of the committee on incorporation in order to conform with the laws of the state of New York. The rules will hereafter be known as the "constitution," and under its provisions the secretary is now elected by the Institute at large instead of the council. The system of cumulative voting is abolished. Copies of the revised constitution will be mailed to the members, with the ballots, on or before April 15th.

The following named associate members were elected:

Philander Betts, 3d, Washington, D. C.; Charles Frederick Burgess, Madison, Wis.; A. Wright Chapman, Brooklyn, N. Y.; William Edgar Firth, Philadelphia, Pa.; Frank R. Ford, M. E., New York; Lucius T. Gibbs, Milwaukee, Wis.; Ch. Gottlosen, Baltimore, Md.; Elwin Clinton Green, Indianapolis, Ind.; Arthur A. Hamerschlag, New York; William S. Hulse, Baltimore, Md.; M. Arthur de la Lozier, M. E., New York; Frederick Mackintosh, Schenectady, N. Y.; James W. Manson, Jersey City, N. J.; William J. Phelps, Chicago, Ill.; H. Hobart Porter, Jr., New York; Taylor William Ross, Key West, Fla.; Howard R. Sargent, Schenectady, N. Y.; W. M. Stewart, Jersey City, N. J.; Howard F. Thurber, Brooklyn, N. Y.

The following named associate members were transferred to full membership:

F. J. Dommerque, Chicago, Ill.; Harry E. Heath, Windsor, Conn.; M. T. O'Dea, Notre Dame, Ind.; Francis B. Badt, Chicago, Ill.; Willard E. Boileau, Columbus, Ga.; Elmer E. Boyer, Lynn, Mass.; James Mitchell, Rio de Janeiro, Brazil; Maurice Coster, Chicago, Ill.; John E. Lloyd, Philadelphia, Pa.; William B. Potter, Schenectady, N. Y.

At the meeting of the Institute in the evening a paper was presented by Prof. W. L. Puffer of Boston on "A New Method of Studying the Light of Alternating Arcs." Sixty members and visitors were present. After

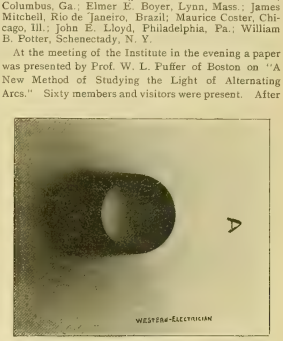



FIG. 4. ON THE SOURCE OF THE RÖNTGEN RAY.

the reading of the paper at 12 West 31st street, the meeting adjourned to Columbia University, where the experiments mentioned in the paper were very effectively shown on a screen.

## National Electric Light Association.

The preliminary arrangements for the transportation of delegates and visitors to the convention of the National Electric Light association and the exposition are progressing. C. O. Baker, Jr., master of transportation, announces that the Central Passenger Committee has granted the rate of a fare and one-third, on the certificate plan, from points in its territory to New York and return. Western members will be interested in the following notice just issued by Mr. Baker:

W. A. Kreidler of the WESTERN ELECTRICIAN, Chicago; Bryan & Humphrey, Turner building, St. Louis, and E. H. Heinrichs of the Westinghouse Electric & Manufacturing company, Pittsburg, will have charge of transportation matters in their respective localities. A special party is being organized in Chicago, which will be joined en route by delegates along the line. A very large attendance is anticipated.

## Chicago Surface Railway Companies to Light Street Crossings Along Their Routes.

Under an ordinance passed by the Chicago city council on January 9th, the commissioner of public works proposes to require the surface railroad companies operating in Chicago to provide and maintain electric lights at all street crossings and intersections along their respective routes. The ordinance became a law by the lapse of the 10-day limit allowed for a veto. The 60 days allowed the companies, therefore, began to run from January 19th, and the limit has therefore expired. It is estimated that 1,640 lights will be required under the terms of this ordinance.

## The Source of the X-ray.

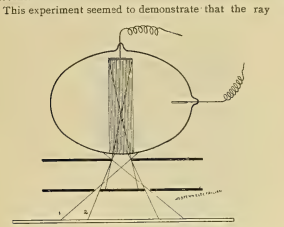
By C. E. Scribner and F. R. McBerty.

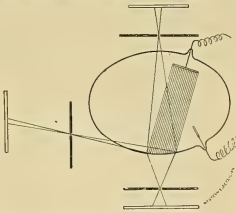
In an effort to locate the source of the X-ray in the Crookes tube, the following experiment was made: Immediately beneath the bulb was placed a screen of lead, thick enough to be nearly opaque to X-rays, with a circular opening one inch in diameter immediately under the bombarded spot of the bulb; 2½ inches below this diaphragm was placed a second screen with two openings of one-half inch diameter, located so far apart that any ray passing directly from the cathode plate through the first aperture would be intercepted by the second screen. Below the second screen was placed a photographic plate. The arrangement is represented in Fig. 1.

A short exposure and development of the plate brought out two densely black elliptical spots on the plate.

Referring to Fig. 1, if the X-ray had proceeded from the cathode alone, in straight lines therefrom, no image would have been produced on the plate. The ray must have proceeded from some point in the tube far below the cathode to have reached the plate at all. The dimensions of the apparatus and of the spots on the plate were accurately measured, and were plotted out to scale in the way frequently used in optics. Lines 1 and 2, carried from the edges of the black spots past the edges of the screen, located the source of illumination at the wall of the bulb. Moreover, the illuminated spots on the plate showed strongly illuminated central disks surrounded by less sharply illuminated parts, such as might be expected to be produced by a source of radiation of considerable area acting through such a system of screens.

This experiment seemed to demonstrate that the ray did not proceed from the cathode alone, unless it was diffused in all directions from the wall of the tube at the point of bombardment. It of course did not differentiate between rays actually proceeding from the glass and rays which might proceed from matter in the same line within the bulb.





FIGS. 1 AND 2. THE SOURCE OF THE X-RAY.—ARRANGEMENT OF APPARATUS FOR EXPERIMENTS.

In the same experiment a pin-hole image of the bombarded spot of the bulb was obtained through a very small hole in the second screen.

Immediately following this experiment, acting upon the hint obtained in it, a number of pin-hole images were taken of different bulbs, the upper screen being absent. In a pin-hole photograph any source of X-rays within the bulb, or on any portion of the wall of the bulb, would necessarily produce its image on the photographic plate below. In every case, however, the image on the plate was solely that of the fluorescent portions of the bombarded spot. The image corresponded in size, form and position with the utmost exactness to that which would be expected from the optical construction, on the assumption that the source of illumination was at the inner wall of the bulb. It was larger than the actual spot in the bulb when the distance from the wall of the bulb to the screen was less than that from the screen to the photographic plate, and smaller under the reverse condition.

No image was obtained in any case of any spot or object within the bulb other than the bombarded spot opposite the plate serving as cathode. The image did not even include the diffusely fluorescent yellowish streaks radiating from the bombarded spot or flickering about the walls of the bulb. Of course with a current which converted the two electrodes alternately into cathode and anode, two spots of bombardment would be obtained.

Figs. 3 and 4 represent two pin-hole photographs of different bulbs. The bulb used in making Fig. 3 had a plain disk of aluminum as cathode. That used for Fig. 4 had a cathode made up of a central small disk of platinum surrounded by a ring of aluminum. The bright lines in the bombarded spot and in the images do not correspond to broad surfaces of the cathode, but to edges or raised portions. These figures are made from India ink drawings copied from the negatives as faithfully as possible, on account of the unsatisfactory character of prints taken from the negatives themselves. The negatives, of course, present the shadings with greater delicacy and evenness, and the outlines more distinctly.

It will be remembered that Prof. Röntgen, in his announcement of the discovery of the X-ray and its attendant phenomena, mentioned that when the stream of radiant matter is deflected by means of a magnet, the X-ray proceeds from the new spot of bombardment. This proposition of Professor Röntgen has been abundantly confirmed by means of the pin-hole photographs. Beneath the bulb, the image of whose bombarded spot is represented in Fig. 5, was placed a diaphragm with a one-inch aperture having a pair of lead cross wires extending over the aperture and crossing at its center. The point of crossing of these wires was located immediately under the center of the series of concentric rings which constitute the source of X-ray illumination in that bulb. Beneath the diaphragm carrying the cross wires was placed the usual diaphragm with a pin-hole aperture, and below that the photographic plate. When all was in readiness the stream of radiant matter, and consequently the spot of bombardment in the bulb, was deflected by means of a powerful electro-magnet, so that the second bright ring crossed the center of the cross wires. After a long exposure the plate was developed; the image showed the shadow of the cross wires and the rings which constituted the source of X-rays lying eccentrically upon them, the most strongly illuminated band—that which appeared blackest on the plate—crossing the center of the cross wires. The source of X-rays had been displaced to a different part of the bulb by the electro-magnet, namely, to the new spot of bombardment. The image is shown in Fig. 5.

A similar experiment was made to determine whether the ray itself could be deflected. The magnet was placed to act upon the pencil of X-rays near the photographic plate, at such a distance that the action of the magnet did not produce any appreciable displacement of the stream of radiant matter, but that it would tend to produce a considerable displacement of the image upon the plate if the ray should be susceptible to its action. The plate was exposed with the magnet unexcited for 20 minutes, and then subsequently with the magnet excited for 25 minutes. If the image had been displaced by the magnet, two like images in different positions should be found upon the plate. As a matter of fact, but one was found, and that in position to indicate that the magnet was of no effect in displacing the pencil of rays outside the bulb.

The evidence of single pin-hole images of the different bulbs would seem to furnish sufficient grounds for the assertion that the X-ray proceeded only from the bombarded spot at the inner wall of the tube opposite the cathode. A further experiment was made, however, which is conclusive on this point. Three pin-hole images were taken simultaneously of the same bulb. One plate and diaphragm were arranged to view the bombarded spot from immediately below. Another plate and diaphragm were placed at the side of the bulb. A third plate and diaphragm were placed above the bulb, in position to look down directly upon the bombarded spot. A special bulb was made having its cathode placed in a somewhat oblique position, so that the bombarded surface might be visible from a point in a line perpendicular to it outside the bulb, without obstruction by the cathode. The arrangement is represented in Fig. 2.

When these plates were developed after a long exposure, the lower plate was found to contain the usual image of the bombarded spot at the bottom of the bulb. The plate at the side contained an inverted side elevation of the same spot. The upper plate also contained an image of the bombarded spot at the bottom of the bulb. On none of the plates was there any other image whatever, although each plate was exposed to the whole bulb. The small spot at the bottom of the bulb at the point of bombardment, on the inner wall of the glass, was the only point about the bulb from which any X-rays proceeded.

The images also tended to show that the source of the ray was at the inner wall of the bulb. If it had been at the outer surface there would have been no glass in the path of rays to the lower plate, and two thicknesses of glass in the path of those to the upper plate; hence the image on the former plate would have been much stronger than that on the latter. If the source were at the inner wall equal thicknesses of glass would be in the paths of rays to the two plates. The images were of such depth of shading as to show that the plates had been equally illuminated, allowing for the difference in distances between the spot and the plates.

No more definite experiment than this seems possible.

These pin-hole photographs were made at different times between February 20th and March 15th, the first described experiment having been made at the earlier date, the last described demonstration about the latter date; the experiments were reported at a meeting of the western branch of the American Institute of Electrical Engineers on March 25th.

From all knowledge which we have been able to gain of the numerous experiments with X-rays, we believe these experiments were the first to locate the source of the X-ray; as respects at least the large number of tubes which we have used, they located the source accurately and conclusively. So far as we can learn also, no other pin-hole images of bulbs have been taken, excepting, perhaps, the one which Professor Röntgen thought he had obtained. This mode of photographing promises excellent results in investigations as to the relation of the X-rays to the cathode discharge.

## Litigation over the Old Villard Deal at Milwaukee.

At last there is reason to believe that the details of the deal by which the Villard syndicate obtained control of the Milwaukee electric light and street railway plants will be thoroughly ventilated before the public. Several persons who were interested in these transactions were known to be dissatisfied with the manner in which they were treated when the settlement was effected, and at different times these persons became troublesome, but were finally induced to remain quiet. Now, however, legal proceedings have been commenced because of a misunderstanding between members of one corporation that was bought up by the Villard syndicate. The plaintiff in the suit is G. Wenninger, who is described in the newspapers as a wealthy real estate man. The defendants are City Comptroller Fiebrantz and Dr. W. H. Earle. Wenninger wants an accounting of the affairs of the Milwaukee Arc Light company, which was absorbed by the Villard street railroad syndicate. Wenninger's suit brings to light the fact that the company was controlled by City Comptroller Fiebrantz, Alderman Koehler and Dr. Earle, and he says that the comptroller and the alderman made use of their official positions to compel the syndicate to buy out their plant. The city officials, it is claimed, desired to keep their connection with the company secret, and when they were threatened with exposure they offered to compromise with the plaintiff in this suit. Wenninger claims that when the efforts of the arc light company to get the contract began to annoy the Villard people the latter, through one of their Milwaukee agents, entered into negotiations for its purchase. The property finally passed to the Villard syndicate, the purchase price being $100,000. Of that amount $55,000 was to be in cash and the balance in the securities of the railroad. Wenninger says that Fiebrantz, Dr. Earle and Alderman Koehler received cash for their holdings, and that they held a meeting and arranged that Wenninger should get $5,000 in cash and about $7,000 in stock. Mr. Wenninger declined to accept the proposition, and Fiebrantz called at his house one night and tried to placate him by offering an additional $500 in cash and $1,000 in stock, he says.

F. B. Rae of Chicago makes a rough estimate that an electric light plant for Madison, Wis., would cost $25,000.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

S. H. Bashor of Waterloo, Ia., is working in the interest of a telephone extension from Ackley to Iowa Falls.

Haines & Melone, proprietors of the Rochester, Minn., telephone exchange, have arranged to connect with the Winona and Union Telephone companies. Connection with Winona is expected by June 1st. The Union Telephone company has exchanges at Austin and Waseca, and will connect with Rochester via Chatfield and Eyota. This company expects to reach St. Paul in time.

A kind of farmers' telephone exchange is proposed at Preston, Minn. The farmers are to erect the lines and pay 50 cents per quarter for the service. Town people will be charged $1 per quarter. It is proposed to divide the country districts into blocks of about five miles each, and all the patrons in each block will pay an equal amount toward the construction of the line, which is estimated at $9 per mile for a double line.

The Le Sueur Telephone company has been organized at Le Sueur, Minn., to build a line to the county seat, Le Sueur Center, and materials have been ordered. Construction will be begun in the early spring.

The Iowa Union Telephone company will build a toll line from Mason City to Northwood, Ia.

The Northwestern Telephone company of Charles City, Ia., will connect with Niles, Powersville, Nashua, Greene, Marble Rock, Rockford, Nora Springs and Mason City this coming season.

The Wisconsin Telephone company expects to have the section of its Chicago-Minneapolis long-distance line between Sparta and La Crosse completed by June 15th. A line from Sparta to Eau Claire is contemplated.

The Northwestern Telephone & Construction company has applied at Racine, Wis., for a telephone franchise.

J. McCormick has applied for a franchise to erect poles to connect Hibbing, Virginia, Mountain Iron, Biwabik, Eveleth and the Vermillion range towns in Minnesota by telephone.

The Union Electric Telephone company of Britt, Ia., proposes to extend a line from Chatfield, Minn., to Austin via Blooming Prairie and Dodge Center.

W. L. Cotterell of Le Mars, Ia., is soliciting subscribers for a telephone system to connect Sioux City, Ia., with Hartington, Dakota City, Wayne and Ponca, Neb.

H. H. Moon and others have applied for a telephone franchise for Hibbing, Minn.

## Central Union Telephone Company Issuing Bonds.

The Central Union Telephone company has decided to issue $1,600,000 of new bonds to pay a floating debt of the company and to provide for new improvements. The Central Union Telephone company owes in the neighborhood of $800,000 to the Bell Telephone company for royalties and for telephone instruments and other apparatus. The Central Union will offer the Bell Telephone company the right to subscribe for these bonds to the full amount of money due the Bell company at the rate of 97½ cents on the dollar. The remaining $800,000 will be offered to the present stockholders of the company at the same rate, or at $97.50 for each $100 bond. The bonds are to be 20-year 6 per cent. gold bonds. From the sale of the remaining $800,000 the company will secure money for needed improvements and for extensions of its present line. The Central Union company has an authorized issue of $10,000,000 of stock, but of this amount only $6,065,000 is now outstanding. The gross earnings of the company for last year were $1,545,253, with expenses of $990,000, leaving as net earnings $555,165, from which dividends of $430,205 were paid, leaving as a surplus only $24,960. So far the company has always paid five per cent dividends. The company owns or controls all of the Bell patents in Indiana, Illinois and Ohio, except Cleveland and Cincinnati in Ohio, Des Moines, Davenport, Dubuque, Cedar Rapids, Keokuk and Ottumwa in Iowa, and five counties in Illinois, of which Cook is one.—*Chicago Tribune.*

## Brooklyn Faith in the Electrical Cure.

The stalwart son of Vermont who can, according to the testimony of seemingly credible witnesses, cure some of the ills that human flesh is heir to by the laying on of his hands is not the sole wonder-worker that has been seen in Brooklyn lately. A resident in an uptown street tells a tale of simple faith, made public by the *New York Tribune*, that is quite as wonderful as any of the feats of "curers" or "healers" who may be regarded as more or less professionals.

This man's business engagements are such that he is kept out every night until the small hours of the morning, and in consequence it is his custom to sleep well through the forenoon. Not long ago his wife, on the advice of a friend, procured an electrical apparatus, which was recommended as a good thing for nervousness and insomnia. The apparatus consists of a sort of harness or gearing, which is attached to the ankle and wrist, and then, in order to form a "ground connection," it is necessary to attach it to a gas fixture, a water-pipe, or something else that runs into the earth. Good results appear to have followed the use of the battery, or whatever it may be termed, and it is well regarded in the family. Now, let the head of this household tell the rest of the story for himself.

"Last week," he says, "I woke up about nine o'clock one day and got so wideawake that it seemed impossible for me to get asleep again that day. My wife was within call, and urged me to try to sleep some more. I told her I didn't think there was any use of trying, but that I would take a book and read a while in bed anyway. Then she suggested that I should try the electrical apparatus, which had done her such evident good. I said all right, and off she went and got it. In due time I had the machine looped around my wrist and ankle and the proper connection formed with one of the gas fixtures. I am frank to confess that I did not have a vast amount of faith in it, but in spite of that I had not had it on more than five minutes before I began to feel a sort of glow steal over my body and a drowsy feeling come over me. I told my wife that I was getting sleepy and after expressing her gratification at the good effect she tiptoed softly out of the room.

"There was nothing to disturb me, and on I slept. When at last I woke I found, to my astonishment, that it was two o'clock—long after my usual hour for rising. I was still in harness, so to speak, and disengaged myself as speedily as possible, and then proceeded to examine the apparatus more carefully than I had ever done before. First I read the directions which said, when through using, to turn the switch off. I undertook to do this, but soon ascertained that the switch was at the point marked off, and not at the button on the opposite side, which seemed to indicate that at that point it would be on. In short, the switch had been open all the time, and there had been no possibility of a current passing through the thing while I had been sleeping, as I supposed, under its effects. My wife had gone downtown when I got up, but when she returned the first thing I did was to get her to examine it, only to have my own impression confirmed, that the switch had been turned off all the time.

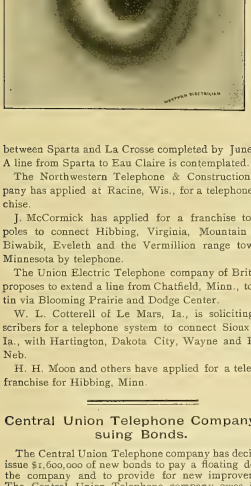
"I have been wondering ever since what it was that gave me those five hours of beautiful, restful sleep. Apparently my faith was as powerful as the electric current, taking it for granted that one is generated in the manner claimed by the inventor of the machine. I am not quite sure whether the joke is on myself or my wife. She naturally supposed that the switch was set right, but I tell her that just as likely as not half of the time she gets the same benefit from it that I did when the switch is open, and that, anyhow, the good results are largely a matter of imagination."

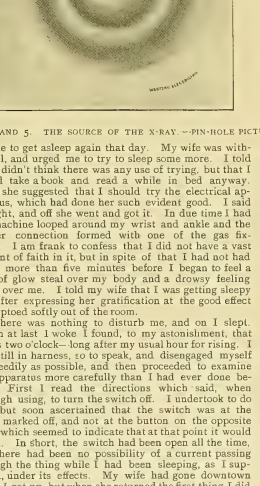
## A Large Plant.

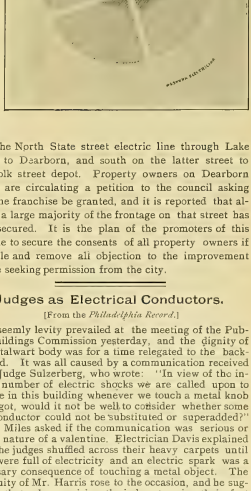
An idea of the size of the mechanical and electrical plants installed in the great retail stores in cities like Chicago may be gained from the following list of apparatus in charge of Chief Engineer W. L. Weber of Siegel, Cooper & Co.'s establishment: Nine boilers, each six feet in diameter and 20 feet long; 14 pumps, including one for fire pressure and three air pumps; 30 engines, including two large Corliss slow-speed engines, with cylinder dimensions of 24 by 42 inches, for driving the main electric lighting plant, five ventilating engines, 18 elevator engines and five other engines for various purposes; 11 dynamos seven arc machines and four incandescent having a capacity of 350 arc lamps and 2,200 incandescent lights; 16 electric motors, ranging from two to 10 horse power each, and two ice machines.

## Proposed Extension of Overhead Trolley in Chicago's Business District.

Following the example of the Chicago City Railway company, which penetrated the heart of the down-town business district with the overhead trolley line on South Clark street, the North and West Chicago Street Railroad companies will endeavor to obtain similar privileges from the city. President Yerkes says: "Our patrons have petitioned us to substitute the trolley at the down-town terminals, and we believe the interests of the public really demand it. There is no plan on foot to substitute electricity on the cable roads." It is proposed to extend the North State street electric line through Lake street to Dearborn, and south on the latter street to the Polk street depot. Property owners on Dearborn street are circulating a petition to the council asking that the franchise be granted, and it is reported that already a large majority of the frontage on that street has been secured. It is the plan of the promoters of this scheme to secure the consents of all property owners if possible and remove all objection to the improvement before seeking permission from the city.







FIGS. 3, 4 AND 5. THE SOURCE OF THE X-RAY.—PIN-HOLE PICTURES.

## Judges as Electrical Conductors.

[From the *Philadelphia Record.*]

Unseemly levity prevailed at the meeting of the Public Buildings Commission yesterday, and the dignity of that stalwart body was for a time relegated to the background. It was all caused by a communication received from Judge Sulzerberg, who wrote: "In view of the infinite number of electric shocks we are called upon to endure in this building whenever we touch a metal knob or spigot, would it not be well to consider whether some non-conductor could not be substituted or superadded?"

Mr. Miles asked if the communication was serious or in the nature of a valentine. Electrician Davis explained how the judges shuffled across their heavy carpets until they were full of electricity and an electric spark was a necessary consequence of touching a metal object. The ingenuity of Mr. Harris rose to the occasion, and he suggested that rules requiring the judges to raise their feet at least 1½ inches at every step be placed in conspicuous places in the courts. As this would involve some expense, Mr. Stevens thought it would be better to supply the judges' pockets with horse chestnuts to work a charm on the electricity, and somebody else suggested that rubber shoes would be an efficient remedy.

An electric line 20 miles long, running from Saginaw, Mich., to a suburb, has just been equipped by the General Electric company. A speed of 40 miles an hour is guaranteed.

Western Electrician.
EVERY SATURDAY.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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## HIGH WATER MARK
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THE publication offices of the WESTERN ELECTRICIAN have been removed to much more commodious quarters. Our new address is Suite 510 Marquette building, Dearborn and Adams streets, Chicago.

The telephone number remains unchanged—Main 1746.

ONLY a comparatively small proportion of the people of Chicago have any idea of the character, scope and importance of the work now being done in this city at the educational institution founded and conducted under the patronage of P. D. Armour. The meeting on Wednesday evening of last week at which Röntgen's discovery was discussed served as an opportunity to impress upon many interested in scientific work the advantage which are afforded by this admirably equipped institution. The facilities which have been placed at the disposal of Chicago by Mr. Armour, and the excellent work of the gentleman interested with him in conducting these establishment cannot be too highly valued. The latitude is generally appreciated, and those who are familiar with it speak in the highest terms of the organization, management and results thus far accomplished, but we think that the nature and extent of the undertaking are not sufficiently well known.

NOT a few engineers and designers are devoting their attention at the present time to the subject of electric elevators. In large cities particularly there is a splendid field for this application of electric power, and architects and builders have not failed to show their appreciation of the advantages presented and to advise the introduction of the electric elevator in preference to other types when power could be conveniently and cheaply secured. It is noteworthy that the government is specifying electric elevators in its advertisements for bids for public buildings wherever the conditions will warrant. At the present time, it is announced, power is furnished for operating 250 electric elevators by one central station company in Chicago.

CARD parties on trolley cars have proved a pleasing social innovation in Brooklyn. It is a development of the summer night trolley excursions into the country districts that proved so popular last year; but this is a much more elaborate affair, and is not expected to be so generally patronized as last summer's scheme. One street railway company in Brooklyn has put into service two handsomely finished parlor cars, and they have been constantly in demand. It is proposed to use these cars only for this special service of carrying private parties to suburban points. A popular trip is to Jamaica, nine miles from Brooklyn, the passengers engaging in progressive euchre during the trip. At the end of the ride supper is served, followed generally by a country dance. The novelty of the idea alone insures its popularity.

IN every gathering of street railway men of this country during the last few years the subject of "transfers" has received serious consideration, and many suggestions have been advanced with the view of checking the abuses that have grown up in many cities. It may be said that the transfer privileges extended by street railway corporations are abused in every city, and these abuses assume great importance in the smaller communities because the earning capacity of the property is so limited that any considerable decrease in the revenues at once precludes the possibility of a dividend for the stockholders. It is not to be wondered, therefore, that the subject appeals to every street railway manager and that much thought is devoted to the solution of the problem. To illustrate the case it is only necessary to relate the conditions existing in a thriving eastern city of 150,000 inhabitants. The street railway lines are owned by one corporation, the service is good and the management has introduced a comprehensive system of transfers by which a person may go to any part of the city for a single fare. All the street railway lines penetrate the heart of the city, and at the center of the town, where all the routes converge, transfer may be made from one line to another. It so happens that in laying out the routes several lines were made to traverse parallel streets very near together, and it is upon these lines that the principal abuses exist. Many persons go down town on one line, securing a transfer at the end of their journey, transact their business and return by another line close to and parallel with the first one, using the transfer received at the end of the down-trip instead of paying a second fare. This is a common practice, the company claims, but it has been found impossible to prevent this abuse. Another method of beating the company is for a passenger to take a transfer at the end of his journey and give it to some person who may be waiting for a car. Instances have been noted where transfers have passed between strangers, so common is the practice, and at least one systematic plan for cheating the corporation was discovered by a stockholder whose interest in the road was not known to the persons who benefited by the fraud. Two workmen who were employed in a large establishment, one going on duty when the other quit work, made a practice of securing transfers on leaving the car, thus reducing the expenses for street car fare 50 per cent. Thus when Jones went to work in the morning he took a transfer which he gave to Smith, whom he relieved from duty, the latter riding home without additional expense. In the evening Smith got a transfer when going to work and gave it to Jones, allowing him to ride home. The street railway company claims to have discovered many similar instances, and no doubt the same practice prevails in other cities. It is for this reason that transportation companies are opposed to issuing transfers at all. It seems to be impossible to establish a system that will not be abused by patrons of the company. The most remarkable feature of this is that many persons consider it a really meritorious act to take advantage of a street railway corporation. Of course such persons are guilty of dishonesty and in many cases they are responsible for the offenses of others, having aided and abetted them in dishonest acts. But the persons guilty of such practices have not a fine sense of moral obligation and as long as they are able to beat the company they will do so. No wonder then that street railway companies give the subject of transfers much thought and that it is always an interesting topic for discussion at street railway gatherings.

AS USUAL our well-meaning but ill-advised contemporaries are only just discovering what this journal pointed out a year ago, but they have not yet reached the point where they fully comprehend the situation. Their attitude suggests the idea that they have been taken completely by surprise by the recent announcement of an arrangement (based principally on the Tesla and Van Depoele patents) between the Westinghouse and General Electric companies, and that they do not as yet fully realize the exact nature of the agreement. There is, of course, no justification for the bewilderment which seems to have been occasioned among our contemporaries by this combination, and it can only be explained by their lack of facilities for gaining exact and trustworthy information. It would be hard to find a better illustration than that which this case affords of the comparative merits of a powerful and influential journal with the resources and advantages of the WESTERN ELECTRICIAN and the less favored publications which are now struggling to create an impression upon the trade by the zeal which they affect in exploiting the alleged details of the combination and giving publicity to all sorts of conjectures that can only result in disturbing the condition of the market and in raising fears in the minds of intending purchasers and investors. We commend to the careful consideration of our erratic contemporaries the following extract from a letter just received from the treasurer of a large electrical manufacturing company in opposition to the combination:

It seems to us it is a mistake to admit that the combination of the General Electric and Westinghouse companies is critical to the independent companies. The combination cannot force the independent companies out of business, and the worst they can do is to bring suits for infringement, most of which will be simply bluff games.

More than a year ago this journal had exact information of the negotiations then pending between the Westinghouse and General Electric companies, and in an editorial, which is reprinted on another page of this issue, the conditions which would be brought about by the proposed compact were clearly outlined. It was shown, too, that this arrangement would not be as far-reaching in its effect as was generally anticipated, and this view has been accepted by at least one of our contemporaries, which, in its last issue, said:

Any man to-day, who is a competent designer and builder, can turn out a direct current dynamo or motor of the best form and the highest efficiency, and pay tribute to nobody. This is true of practically all sizes. Not less is it true of alternating current apparatus of the generating class. We know of nothing that can restrain anyone from manufacturing good alternating generators.

Our contemporary, it will be noticed, not only adopts our view, but presents it in almost the identical language which we employed.

The condition of the electrical field to-day is precisely that foretold by this journal on March 30, 1895. In the announcement of the proposed combination we said:

It would be impossible for the consolidated General Electric and Westinghouse companies or any other combination to monopolize the electrical business of the country, and no one knows this fact better than the astute gentlemen who control the great corporations named. Possibly the two companies have found that patent litigation and rate cutting are unwise and unprofitable and have agreed to compete in business on different lines and with less feverish eagerness.

This view was supported at the time by a well-informed patent attorney of Chicago, who said in an interview in the WESTERN ELECTRICIAN:

The electrical manufacturing industries of the country have reached a point where a general amalgamation would be almost an impossibility. There are several very large concerns which will not enter a combine under any circumstances. One is in this city.

It may be added for the benefit of those who prate about combinations, monopolies and trusts, that it is not within the range of possibilities for the General Electric and Westinghouse companies to control this field, and that should they be so foolish as to engage in such an undertaking, even to the extent of instituting intimidating or "bluff" suits for infringement, they will provoke the resentment and opposition which such a policy would deserve.

## Our Vociferous Contemporary One Year Behind the Times.

[Editorial in WESTERN ELECTRICIAN, March 30, 1895.]

Rumors have been in circulation during the last few weeks of a proposed consolidation between the General Electric and Westinghouse companies. Similar reports have been spread at intervals before, but have never come to anything. *This journal has always maintained that it was impossible for any one company or consolidation of companies to control the electrical business* because of its nature, which is widely different from that of some single material product. All attempts to control the situation so far have been failures.

With this experience it is easy to see that such a combination of interests for such a purpose would simply invite increased competition. Any well-informed electrical engineer can design satisfactory electrical machinery, and nowadays this can be done without costly experimenting. Moreover, small manufacturers, unhampered with immense interest-bearing indebtedness and enormous capital stock to pay dividends on, can enter the field and build any particular line of electrical machinery as cheaply as the larger companies. To-day, without a single fundamental patent to depend on, with all classes of material that enter into electrical construction to be bought freely in open market, it is unreasonable to suppose that any such attempt will be made. On the other hand, it is quite probable that the two companies mentioned have become weary of litigation, achieving nothing and transferring their profits to the pockets of the lawyers instead of to the stockholders, and no doubt they are anxious to perfect an arrangement which will put an end to such a state of affairs. That they should attempt a policy of extermination to smaller concerns is unlikely, as they would most assuredly be worsted in the long run. On the contrary, it would seem that the agreement is to be made to put an end to profitless lawsuits. Such a course might go far toward settling and solidifying the electrical industry, encouraging capital to invest freely in the many advantageous enterprises that are open to it. Furthermore, the present prices of electrical apparatus are exceedingly low, but with the cessation of legal hostilities it is possible that the wild cutting of prices will cease, too, and goods will not be sold at a mere living profit or a distinct loss. This would mean better prices all round, in which all engaged in the industry would share. With the business outlook brightening in all parts of the country, and a good demand for apparatus, the industry is in a most hopeful condition.

*No combination will ever control this entire business or drive out legitimate competition from the field: the field is open and will remain so.*

## Texas Street Railway Association.

The third annual meeting of the Texas Street Railway association was held at Galveston on March 18th and 19th, with the president, W. H. Sinclair, in the chair. After an opening speech by the president, members of the association discussed methods of administration and operation. In canvassing the efficiency of employes it was shown that the average pay of conductors was $1.55 per day, the working day generally consisting of 12 hours.

Mr. Drake suggested the organization of the Texas Street Railway Mutual Insurance company. According to the plan proposed, 10 per cent. of the gross earnings of each line, together with the regular insurance charges, according to board rates, is to be paid into the treasury annually, a certain percentage to be kept in reserve. With the rest of the money employed, after $100,000 had been paid into the treasury, a corporation could be regularly organized. Until that all payments would have to be upon honor. A permanent committee upon insurance was appointed as follows: Carl F. Drake of Austin, chairman, H. C. Chase of the Houston City Railway company, J. L. Sale of Dallas. This committee was made permanent, and the president and secretary were added to it in an advisory capacity.

W. H. Sinclair of Galveston was elected president and Carl F. Drake of Austin vice-president; C. L. Wakefield of Dallas, secretary and treasurer. These, with A. H. Hayward of Houston and George B. Hendricks of Fort Worth, form a directory of five. The next meeting will be held at Austin on the third Wednesday in March, 1897.

The companies represented were: Dallas City Railway company, Houston City Street Railway company, Galveston City Railroad company, Fort Worth Street Railway company, Laredo Electric & Railway company, Austin Dam & Suburban Railway company, Austin Rapid Transit Railway company, Queen City Railway company of Dallas.

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It is stated that an electric railway will be built to connect the towns of Lansing, Battle Creek and Kalamazoo in Michigan. Such a line would be 75 miles long. It is proposed also to construct a spur three miles long to Gull Lake, a popular summer resort. It is proposed to operate the cars at high speed and to carry mail and express matter as well as passengers.

## One Year of Electric Power Transmission at Niagara Falls.

BY ORRIN E. DUNLAP.

It was one year ago to-day, on the morning of April 4, 1895, that Rudolphe Baumann, the Swiss engineer, moved the small hand-wheel which controls the first great turbine in the central station of the Niagara Falls Power company. Then the field of the generator revolved, quietly, effectively, and the civil, hydraulic and electrical engineers who had helped build the plant knew that their work was a success. The machine which has the power of transforming the energy of water into electrical energy was all it was expected to be, and since then two others have been successfully erected. All that remained to be done one year ago was the construction of proper conductors to convey the electrical force to the point of application and use, and since then this has been done, so that to-day the lands of the Power company are enlivened by several factories, the growth of a year. The major number of these have been reviewed in the WESTERN ELECTRICIAN. Briefly recalled, they are a carborundum plant, an aluminum plant, a carbide factory and a potash and sodium works. In addition to these the power from these mighty generators, built by the Westinghouse Electric & Manufacturing company, is being used for operating the Buffalo & Niagara Falls electric railway, the several electric lines in the city of Niagara Falls, and it is also being used to light Niagara Falls. Other factories are in process of erection, all demonstrating that the first year of application of power from the huge dynamos has been an unqualified success.

An extension 30 by 60 feet is being made to the carbide plant. At present the building contains four furnaces, but they are not continuous. The officials say they have a continuous furnace ready to build, which they expect will materially lessen the cost of production.

In the upper river plant of the Pittsburg Reduction company the foundation has been built for the first 600 kilowatt transformer, which is one of the steps toward the enlargement of the plant. The machine is expected to arrive during April.

The Carborundum company is about prepared to start its kilns and the manufacture of its various goods at the Falls, a work which heretofore has been carried on in Monongahela City, Pa.

As a result of the hearing on the bill relating to the power to be legally enjoyed through the hydraulic canal development, the bill has been amended to allow of the development of 100,000 horse power instead of 200,000, as at first framed. In this form it is likely to become a law, as it has the sanction of the commissioners of the state reservation. This will give the canal company the right to develop the same amount of power as is obtainable through the present tunnel.

There is a general hope that the state reservation will be lighted by electricity during the coming summer. In no respect have the commissioners of this park been so negligent as in failing to properly illuminate the grounds in their charge. On all sides they are roundly and severely condemned. Popular drives, open at night, pass through the grounds, and the people demand that they shall be lighted the same as any street in charge of the municipal government. Experience shows that darkness leads to crime.

The iron work for the new plant of the Pittsburg Reduction company, to be located on the Canal company's lands, is on the ground, and the work of erection will commence ere long.

In the new potash and sodium works foundations have been built for two 250 horse power transformers.

The new plant of the Niagara Electro-chemical company, on the grounds of the Niagara Falls Power company, is being built. Rogers & Co. of Buffalo have the contract. This chemical company is controlled by Hasslacher & Co. of New York. When completed the works will cover a plot of ground 300 by 250 feet, but at present only an office building, a mill building and a boiler house will be erected, all of which will be of brick. The office building will be two stories high and have a frontage of 80 feet on Buffalo avenue. The mill building will be 140 by 160 feet, and the boiler house 40 by 67 feet.

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The deficit (including interest on purchase money) in the British government telegraph system has been tabulated as follows for the last three fiscal years:

March 31, 1893.............£465,570 (over $2,250,000)
March 31, 1894.............£477,327 (over $2,310,000)
March 31, 1895.............£452,803 (over $2,191,000)

This is an average of £465,233 (over $2,251,000) for each of the three years named.

## Water-tube Boilers.[1]

BY W. T. BONNER

Steam boilers perhaps have not attained that degree of perfection usually accorded to the steam engine, yet when we note the progress which has really been made and realize how close we have approached to the theoretically perfect boiler, we have great cause to feel encouraged.

Of the two hundred and sixty odd boilers recorded in Mr. Bell's most valuable "Directory of Canadian Mining Industries," 30 per cent., or 5,400 horse power, are of the water tube type, and 50 per cent., or 9,000 horse power, are shell boilers, leaving 20 per cent., or 3,600 horse power, unclassified.

Since practically all of the above water-tube boilers have been installed within the past 10 years, we can safely infer that, in the mining trade at least, more horse power of water-tube boilers are now sold each year than all the other types combined.

There is no better evidence of the survival of the fittest in modern boiler practice than a comparison of the various types exhibited at the Centennial Exhibition of 1876 with those shown at the World's Fair 17 years later. At the Centennial there were exhibited 15 different types of boilers, of which two were cast-iron sectional, four were shell or tubular boilers, two were shell boilers with water-tubes crossing internal fire tubes, while seven were exclusively water-tube boilers. Of the whole number exhibited at the Centennial, but one, the Babcock & Wilcox, reappeared in its original form at the World's Fair in 1893. Of the 52 boilers exhibited in the main boiler room at the World's Fair, all were of the water-tube type, while 31 of them were distinct copies of the original boiler patented by Stephen Wilcox in 1856, just 40 years ago.

Few boilers there are entirely devoid of all good talking points, but do not be satisfied with a boiler simply because it is made of good materials and workmanship, or because it has a mud drum, or because it has large water and steam capacity, or because it has a large disengaging surface, or because it has a good circulation, or because it is built in sections, and is therefore safe in the event of explosion, or because it is able to withstand high pressure and unequal expansion, and has its joints protected from the fire, or because the furnace is provided with chambers for the proper combustion of the gases, or because the heating surface is composed of thin metal so arranged that the heating gases will cross it at right angles and only leave it when the greatest possible heat is extracted from them, or because it will work up to or over its full rated capacity with the highest economy, or because it is fitted with the best quality gauges and fittings. Each of these qualities add greatly to the value of a steam boiler, but that one is best which combines the greatest number of such qualities, and therefore proves the best investment independent of first cost.

Messrs. Galloway, Ltd., of Manchester, Eng., illustrate on page 94 of their late catalogue, what they are pleased to designate as their "Manchester boiler," but which is in reality a reproduction of the ordinary inclined water-tube boiler, built by so many manufacturers of to-day. In explanation of this marked deviation from the Galloway, Lancashire and Cornish boilers which they have been building for so many years, Messrs. Galloway, Ltd., say:

"For ordinary pressures the Galloway boiler possesses great advantages, but beyond that cylindrical boilers are frequently of large diameter, necessitating extremely heavy plates, and although for marine practice this is carried out, yet for situations where the conditions are less rigid it is advisable to have a boiler more suited to the requirements of the case.

"In addition to this, where transport of large pieces is difficult, the Manchester boiler offers considerable advantages, as the largest piece is the upper vessel, which rarely exceeds five feet in diameter, 20 feet in length and four tons in weight, the tube rods and boxes being separate. It will be seen that all the tubes are inserted into one water box or chamber at each end, the front one connected to the upper vessel by a wide neck, and the back chamber by a large circular connection, by which means an even circulation is kept up. The boiler is further provided with an internal arrangement in the upper vessel for separating the steam from the water, thus preventing priming and its attendant evils. This arrangement of boiler has been largely adopted on the continent, and we anticipate that, when its merits become known, it will be received with great favor by steam users requiring boilers for high pressure."

That is good; coming from such an eminent authority, we can only interpret their adoption of the water-tube principle as a strong endorsement of the work accomplished by their predecessors in that field of engineering. I fully expect, however, in the next issue of their catalogue, Messrs. Galloway will have overcome their prejudices sufficiently to limit the diameter of their drum to 36 or 42 inches, and that they will further arrange to enclose the drum so as to utilize its surface for heating rather than condensing. Then they may add to the merits of their boilers safety and economy.

I might add that although Messrs. Galloway are pleased to limit the use of their water-tube boilers to stationary work, the boilers of that type are just now making tremendous strides in the race for supremacy in marine practice.

In proof of this statement I might refer to the steamers Turret Cape and Turret Crown, which have just closed a very successful season in the coal carrying trade between Sydney and Montreal. From their lessees, the Do-

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1. Abstract of paper read before the sixth annual meeting of the General Mining association of the Province of Quebec, held at Montreal, January 8-10, 1896.

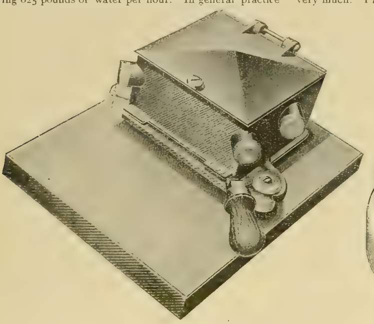
minion Coal company, I learn that the two steamers have a combined record of 27 trips, extending over a period of 44 weeks, during which time they brought 66,981 tons of coal into this port. To this total should be added 11,700 tons for short cargoes, made necessary by the very low water in the river and canal, which difficulty prevailed through all of last season. Had there been a sufficient depth of water both steamers could just as easily have brought in a full cargo each trip.

The actual carrying capacity of each of the Turret boats is 3,000 tons. They are fitted with water-tube marine boilers, 2,200 square feet of heating surface being the total for each boat. They have been kept in continual service right through the season, and the captain's log shows a clean record for the boilers.

Many other and larger steamers fitted with water-tube boilers have gone into commission during the past few months, and in every case the boilers have given the greatest satisfaction.

The term "horse power" is one which admits of a wide interpretation, being little understood by some and often misapplied by others. Originally used as a unit of capacity by James Watt, and supposed to be the average amount of work performed by a good strong English cart horse, its value is 33,000 pounds, raised one foot high per minute. It may be expressed in any equivalent of this unit, as one pound raised 33,000 feet high per minute. At best this is but an arbitrary unit, since the actual value of a horse power depends, as a Yankee boiler maker has very aptly expressed it, upon the size of the horse. The evolution of the term "horse power" as applied to steam boilers has been gradual, but not the less marked.

Prior to the advent of compound and triple expansion engines, it was always customary to calculate the steam consumption of the ordinary slide valve engines then in most common use at the rate of one cubic foot of water per hour, or say 62½ pounds. For instance, a 10 horse power engine would require a boiler capable of evaporating 625 pounds of water per hour. In general practice



BRADY'S ARC CUT-OUT BOX.

it was found that boilers of different types of construction varied in evaporative capacity according to the efficiency of their total heating surface, the amount required per horse power averaging about as follows: For plain cylinder boilers, 10 square feet; for large flue boilers, 12 square feet; for horizontal and multitubular boilers, 15 square feet.

Of late years tremendous strides have been made in the development of the steam engine, so that instead of one cubic foot of water, or 62½ pounds steam consumption per horse power per hour, the modern engine builder knows that he must develop a horse power with less than 30 pounds of steam for simple non-condensing engines and from that down to 13 pounds or less for triple expansion condensing engines, depending upon the size of plant and number of cylinder expansions.

Here then arises a serious complication in the determination of horse power. Shall it be a large or a small horse? The prospective purchaser should consider this matter carefully and demand that all tenders must state specifically the actual evaporative capacity of boilers to be purchased, to be determined if necessary by a practical test. The American Society of Mechanical Engineers has very properly solved this problem by the favorable consideration of its special committee's report at the New York meeting in 1884, whereby the equivalent evaporation of 30 pounds of water from a temperature of 100° Fahrenheit into steam at 70 pounds pressure is fixed as 1 boiler horse power.

American manufacturers generally have adopted this standard, and while they may differ in the number of square feet of heating surface they allow for developing a horse power, there is no longer any doubt as to the size of the horse.

I cannot leave the subject of horse power capacity without first making a strong appeal for a more uniform rating of boilers, a rating which has some tangible basis. Not until we are able to compare boilers by the actual number of square feet of effective heating surface they contain or the actual number of pounds of water they will evaporate under ordinary working conditions can we judge whether one boiler is cheaper than another.

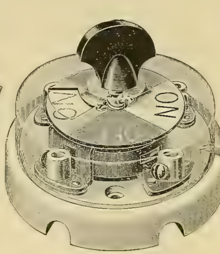
I [illegible] only a few days ago, [illegible] tube boiler man that he only figured the upper half of his tubes as effective heating surface. I shall always remember him as an honest man of good sense. There is no question that fire tubes and shell plates exposed to the direct action of hot gases form very efficient heating surface when they are clean, but who is there who will claim the possibility of keeping such surface constantly clean while the boiler is in active service?

Effective heating surface is that which receives the direct contact of the hot flames or gases and continues to do so without interruption from soot, or interference by close furnace walls or baffle plates. This is the proper basis upon which to purchase your boiler, other conditions of course being equal.

I have been asked why a water-tube boiler is necessarily a safety boiler. It is not necessarily a safety boiler; in fact, I could name a number of water-tube boilers which are safe in name only. Certainly a boiler with very wide, flat stayed surfaces, enclosing chambers receiving the combined circulation of all the tubes, should not be considered a safety boiler. Stay bolts and braces at best are a constant menace to safety, since they are usually located in inaccessible places, difficult to inspect and repair. But the principal objection appears to be the impossibility of providing braces which brace at the proper moment. How is it possible to assemble a number of pieces of metal, all of different sizes and shapes, and subject to greatly varying temperatures, and expect them to expand, contract and remain uniformly tight at all times? But it is to be regretted that in defending the principle of water-tube boilers, there are other weaknesses to apologize for than braces and stays. There are those with tubes closed at one or both ends, the aggregation of pipe and fittings and the bent tube monstrosities, so aptly described in a recent publication called "Facts", all more or less dangerous because they cannot be cleaned.

DISCUSSION.

MR. FERGIE. Mr. Bonner's paper has interested me very much. I had a conversation with him last night



PERKINS 500 VOLT SWITCH.

on the subject of the comparative merits of the Babcock & Wilcox and the Stirling boilers. We are using a battery of Stirling boilers at our mines, while our neighbors have Babcock boilers, so we have a great opportunity of comparing them. The only objection I have to the water-tube boiler is the small steam capacity, and I claim the Lancashire boiler has an advantage in that respect. Two weeks ago something went wrong with the feed valves on the Stirling boilers. If they had been Lancashire boilers we could have run for three hours afterward. As it was, we immediately shut off the water supply, compelling us also to close down the mines and withdraw the men. Another objection I find is that water-tube boilers are more liable to prime. Mr. Bonner informs me that they should not. We cannot get as dry steam with the water-tube boilers as with the Lancashire boiler. Otherwise, I am satisfied that it is a cheaper boiler in every respect, and, with regard to the consumption of fuel, more economical.

MR. LECKIE: I may say in a general way that a boiler that would suit for one purpose, under certain conditions, might not in another. For instance, water-tube boilers are being placed on the new fast torpedo boats, as being best adapted for that purpose. They are of the Yarrow and Belleville types, very similar to your (Babcock & Wilcox) marine boilers, I suppose, with some modifications. Marine boilers are under the care of experienced engineers and firemen, whereas miners have to look to possibilities that render necessary a plant of less refinement, one that will work under different conditions, such as Mr Fergie mentions, where we have very dirty water and where we want boilers that are not liable to get out of repair. Sometimes it may be we are 50 miles from a repair shop, and a boiler less liable to get out of repair, even though it wastes a little more fuel, would be preferable. It is the same with steam engines. After all, the most efficient boiler for a miner is one that will work with dirty water when necessary, and require very little repair. I have had at Londonderry three Lancashire boilers made by Galloway, in Manchester, which have been running over 18 years, and yet have not cost a dollar for repairs. We can work up to 80 pounds pressure with them but for very high pressure they would be unsuitable. Where you would run up to 250 or 280 pounds as they do in the new torpedo catchers, they would be altogether unsuitable.

MR. BONNER: I can readily concede the force of Mr. Leckie's argument that water-tube boilers may not be best for all purposes, but the exception must be some place where neither efficiency, safety, durability nor economy have any consideration. Do not understand me, however, to claim that we have the only good boiler. There are many other good boilers besides the Babcock & Wilcox, but when you want the best, examine our record—you will find the evidence all on our side.

The first cost of a good water-tube boiler is considerably more than a shell boiler of equal rated capacity, and for that reason the prospecting miner, or the beginner of any small or uncertain manufacturing plant with a limited capital, very wisely crawls before he leaps. For permanent works, however, employing steam in any considerable quantity, whether they be operated by skilled or unskilled labor, there is no longer a single argument to be advanced in favor of shell boilers which cannot be met by half a dozen in favor of water-tube boilers. The three Lancashire boilers mentioned by Mr. Leckie have certainly given very satisfactory service, but he also admits they are unsuitable for pressure above 80 pounds. The history of the Babcock & Wilcox boilers, crude as they were in their infancy, will compare very favorably with the Lancashire boilers in point of durability, and when we consider the many instances of criminal carelessness on the part of attendants who do not hesitate to pump cold water into red hot boilers, the wonder is that the repair account can still be expressed in fractions.

MR. SWORD: What I consider the main point has been somewhat overlooked in this discussion. It is not a question which boiler is the best, as if one boiler could be better than another under all circumstances. It is really a question of what kind of boiler is most suitable for particular requirements. I think all the boilers mentioned have their proper place. In Mr. Bonner's clever and instructive paper he does not touch on this, neither does Mr. Fergie state the advantage of a Lancashire over a water-tube boiler. I think that where the water is bad, requiring frequent cleaning of the interior surfaces, also where fuel is cheap, and the cost of boiler a considerable factor, that a shell boiler is hard to beat.

Regarding water-tube boilers, I do not think Mr. Bonner has laid sufficient stress on the almost absolute safety of this type of boiler, as the greatest damage that could result in the event of a rupture of the boiler would be to injure the attendants by scalding, whereas in the case of explosion of a shell boiler the usual result is the complete destruction of the building and great loss of life. The only part of the Babcock boiler liable to deterioration is the tubes, and in the event of their giving away from overpressure, they act like a safety valve or a fusible plug, and the damage can be easily and cheaply repaired. I never heard of a drum wearing out or bursting. As the tubes form the principal part of the heating surface of a water-tube boiler, the drums can be built of extra thick plate without lowering the heating capacity as would be true in the case of a cylindrical boiler in which the shell forms a large part of the heating surface. I think therefore, where fuel is expensive, where pressure can be used and absolute safety from explosion is of great importance, that a Babcock & Wilcox boiler is preferable to any other.

## Brady's Arc Cut-out Box.

Capt. T. H. Brady of New Britain, Conn., the well-known manufacturer of mast-arms and other specialties for line construction, has brought out the arc cut-out box which is herewith illustrated. It is built on an entirely new line, with adjustable jaws, making a perfect contact at all times. The cut-out has no dead center, has a perfect make-and-break and is thoroughly insulated. A number of these cut-outs have been tried by different central stations, and in every case perfect satisfaction was given. Mr. Brady, who is now manufacturing them on a large scale at his factory in New Britain, has every reason to be pleased with the outlook.

## Perkins 500 Volt Switch.

A small, durable and reliable snap-switch for 500 volt circuits is shown by the accompanying cut. A break of 1¼ inches is obtained, or more than one-third on each side. This switch is made by the Perkins Electric Switch Manufacturing company of Hartford, Conn., in single-pole, double-pole and three-point forms, and "off" and "on" indicating dials can be attached to any switch. This switch is especially adapted for railway circuits, and will undoubtedly be in wide demand.

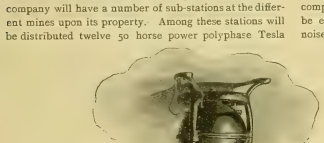
## Home Seekers' Excursions.

In order to give everyone an opportunity to see the western country and enable the home seekers to secure a home in time to commence work for the season of 1896, the Chicago, Milwaukee & St Paul railway has arranged to run a series of home seekers' excursions to various points in the West, Northwest and Southwest on the following dates April 7th and 21st and May 5th, at the low rate of two dollars more than one fare for the round trip. Tickets will be good for return on any Tuesday or Friday within 21 days from date of sale. For rates, time of trains and further details, apply to C N Souther, ticket agent, 95 Adams street, Chicago,

## Elaborate Electric Mining Plant.

When an alternating current electrical power transmission plant was established at Telluride, Colorado, in 1891, the electrical world was much interested in the operation, because it was the first plant of its kind that had ever been installed in this country. The apparatus had been ordered by the San Miguel Consolidated Gold Mining company, a corporation owning gold mining territory in the Colorado mountains. Hitherto it had been commercially impracticable to operate these mines, because the excessive cost of transporting fuel for power to an altitude of 3,000 feet above the sea level made it prohibitive. Electric power was suggested, as the company owned a waterfall in the San Miguel valley, which is of sufficient capacity to operate all its mines if made available. The Westinghouse Electric & Manufacturing company was asked to install a 100 horse power Tesla alternating current generator and a 100 horse power motor, with the necessary switchboard appliances. The generator was connected with a Pelton water wheel and the current was carried for three miles up the mountains to the Gold King mine.

The success of this undertaking was established from the first. The directors of the San Miguel company have become so thoroughly convinced of this fact that they recently contracted for an extensive increase in the electrical plant. The additional machines were ordered of the Westinghouse company some time ago and they are now being installed. These machines are two 800 horse power 500 volt quarter-phase generators running at 7,200 alternations. These generators will be directly connected to two Pelton water wheels, and two 30 horse power multipolar generators will be used as exciters. This apparatus will be installed in the central power house, and the company will have a number of sub-stations at the different mines upon its property. Among these stations will be distributed twelve 50 horse power polyphase Tesla



LUNDELL "WHITE WINGS" CEILING FAN.

motors, fifteen 20 horse power polyphase Tesla motors, twelve 100 kilowatt 500-11,600 volt two-phase-three-phase step-up transformers, ten 50 kilowatt 10,000-220 volt step-down transformers, ten 25 kilowatt 10,000-220 volt step-down transformers and 16 10 kilowatt 10,000-220 volt step-down transformers. The motors will be attached either by belt or direct connection to operate stamps, pans, hoists, crushers, elevators or pumps. It is expected that this installation will prove the most complete electrically equipped mining plant in the world.

## Lundell "White Wings" Ceiling Fan.

The Central Electric company will have a new and decidedly original ceiling fan motor for this year's distribution. This is called the Lundell "White Wings," manufactured by the Interior Conduit & Insulation company, which has established a wide reputation for the standard 12-inch and 16-inch Lundell fan motors. This outfit, as will be seen by the accompanying illustration, is an adaptation of the original types of fan motors and is especially desirable for low ceilings. It is constructed in two sizes, $\frac{1}{4}$ horse power provided with a 26 inch fan and running at 575 revolutions, and $\frac{1}{6}$ horse power provided with a 36 inch fan and running at about 300 revolutions. The $\frac{1}{4}$ horse power motor is wound for 110 to 115 volts only, and the $\frac{1}{6}$ horse power is wound for 110 to 115 volts or for 230 volts, the latter winding making it desirable for operation two in series upon 500 volt circuits. This outfit can be placed on the market at low cost and will undoubtedly have a large sale.

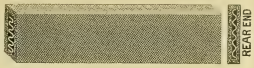
## Exciting Experience in Cable Laying.

George F. Woolston, the president of the Kearny (N. J.) Electric Light & Power company, and George Parsons, an electrician from this city, had a narrow escape from drowning in the Passaic river on Saturday night, says the New York *Sun*. The company has the contract for lighting Belleville, just across the river from Kearny. The power was transmitted by a cable, which crossed the Belleville bridge, but the freeholders of Essex, Bergen and Hudson counties ordered the removal of the cable a few days ago. It was decided to put it across the river at a point about a quarter of a mile below the bridge. The work was begun on Saturday afternoon, and was continued in the evening. It was found that the old cable was too short by about 12 feet.

At about 10 o'clock in the evening some employes were splicing a piece on the end of the cable, and President Woolston and Mr Parsons were out in the river in a boat. Each had hold of the cable. Unexpectedly the off-shore pull which the cable was exerting was greatly increased, and both men were jerked into the river. Neither of them could swim. Mr Woolston clung to the capsized boat. Schuyler Webster and Herbert Clark of the Nereid Boat Club jumped into a boat and were at the scene of peril in a few moments. Webster dived from the boat with all his clothes on and caught Parsons by the hair. Both were dragged into the boat. Woolston, clinging to the capsized boat, had drifted nearly to the Greenwood Lake railroad bridge, but he was soon taken from his perilous position by Webster and Clark. The rescued men were taken to the Belleville Hotel, whence they returned to their homes not much the worse for their immersion.

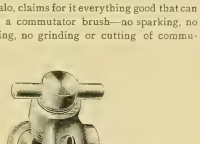
## Aluminum Core Commutator Brush.

The cut shows a dynamo and motor commutator brush which is made of the finest woven wire cloth with a corrugated core of pure aluminum, as shown. The manufacturer of this brush, the Kester Electric Manufacturing




ALUMINUM CORE COMMUTATOR BRUSH.

company of Buffalo, claims for it everything good that can be embodied in a commutator brush—no sparking, no noise, cool running, no grinding or cutting of commu-



"CHUCK" CARBON HOLDER.

tator, perfect ventilation, self-lubrication and ease of filing and dressing. It requires no box support to hold it stiff, and is said to outwear any copper brush. Special sizes are made to order.

## "Chuck" Carbon Holder.

An interchangeable carbon holder for arc lamps is shown in the cut. It is made by the Arc Light Supply company of Elizabeth, N. J., and is said to be sold in quantities for less than the cost of making individual designs of carbon holders to arc lamp manufacturers. It is universal, taking a carbon from one-quarter inch to five-eighths inch diameter, and it will fit any make of lamp. It is simple, strong, durable and strictly interchangeable. The clamping screw being one-half inch in diameter does away with all liability of twisting or breaking off of clamping screw. It is self-cleaning, and always brings the carbons in line with the rack of the lamp.

## The Home of Asphaltum.

In the Island of Trinidad, near the village of La Brea, which is situated on a peninsula of the same name, is one of the most remarkable of submarine volcanoes, which occasionally boils up and discharges a quantity of pretroleum; and one on the west coast spouts smoke and flames from the depths and afterward ejects pieces of bitumen, black and brilliant as jet. A little northeast of Guapo Bay there is a lake of 1½ miles in circumference, 80 feet above the sea level. The headland on which it is located consists of bituminous scoriæ, vitrified sand, mingled with earth and all cemented together. Cinders abound, and there is a strong sulphurous odor apparent as far away as eight to 10 miles back from the shore. Reefs of what seem to be rocks, but which on examination prove to be masses of asphaltum, extend into the sea three or four miles. The inhabitants of the village make the blocks of asphaltum, which are of all shapes and sizes, play many parts, and the result is, to say the least, comical. The under stratum of the soil is of asphaltum, and this changes position with thermal changes wrought by volcanic action, resulting in throwing the light habitations out of plumb, now to the left, then to the right, back and forth, regardless of the wishes of the inhabitants of La Brea.

The road from the village northward gradually rises to the level of the pitchy lake, which latter also has an upward grade toward the east side, and seems to occupy the summit of a hill. The lake is circular in form, and seems formed of million of tons of asphaltum. Before him the tourist gazes on what seems like the bed of a vast, dry pond, furrowed in every direction with innumerable tiny ripples. Dotted here and there are small islands covered with a dwarfed, unhealthy vegetation, which serve as resting places for the thousands of bright plumaged birds, whose melodies and colors are the only joyous elements to enliven this funereal country.

Here and there a commotion occurs in some less solidified portion of the lake, and an enormous bubble breaks the surface, loaded with sulphuretted hydrogen, bursts and scatters its characteristic odor. The center of the lake is semi-liquid, and here a continuous ebullition is going on.

For a certain distance from the shore it is possible to promenade, but even there a change of position at quite frequent intervals is a precaution of safety, and the nearer the center one goes the more necessary it becomes to "move on" because of the increased approximation to a fluid condition.

The depth of this lake is a matter of mere conjecture. All attempts which have been made, up to date, have resulted in nothing definite or satisfactory. The temperature of the locality is often almost intolerable. That of the asphaltum at the center of the lake rises as high as 95 degrees centigrade during the day, and is never less than 51 degrees at night.

Constant additions from below raise the level of the lake by easy stages, the upheaved matter shrinking as it hardens. The volatile matters which render it fluid when first ejected from below gradually evaporate or dry out, which eventually leaves it a semi-solid mass, but which is only so below a given temperature. It can also be rendered fluid again by the addition of the volatile solvents which have been evaporated.

Since the discovery of coal gas and subsequently of petroleum, it has been well settled that the origin of the products, bitumen, coal tar, mineral pitch, etc., by whatever name known, is the slow decomposition of vegetable matter under pressure, resulting in the formation of bituminous coal.

This, in turn, subjected to intense volcanic heat, distils out the asphaltum, which is distributed throughout the crevices of the neighboring rocks, or is driven upward through seams to the surface. In the manufacture of coal gas we have the same process on a small scale, and recover the same residual constituents.

Asphaltum is found on the shores of the Dead Sea, in parts of South America, in Alsace, parts of Scotland, etc.

Its use as an insulator for some forms of electrical work is well known. Mixed with such volatile fluids as ether, turpentine, gasoline, benzine, or naphtha, with which it readily unites, it makes a varnish which is impervious to water, readily solidifies, and where not subjected to a temperature above 40 or 60 degrees Fahrenheit, will do good service on cables and underground woodwork.

## Universal Electrical Directory.

J. A. Berly's publication for 1896 contains the names of the members of the electrical and kindred industries throughout the world. The amount of work entailed in its compilation has considerably increased. It has been most thoroughly revised, and the British alphabetical section now comprises about 8,862 distinct names; Continental, 6,608; American, 4,452; Colonial, 1,590—a total of 21,512, approximately 554 names of individuals and firms more than were contained in the book for 1895. For simplicity and facility of reference it is divided into four groups, namely, British, Continental, American and Colonial, which are again sub-divided into alphabetical and classified sections. In addition to the new names incorporated in the present issue, much financial information is given, the telegraphic addresses and local telephone numbers are given, and 54 pages have been added to the work as compared with that of 1895, making in all about 920 pages entirely of directory matter.

The publishers, H. Alabaster, Gatehouse & Co., 22 Paternoster Row, London, make the claim that "it is the largest and the oldest electrical directory in the world." It is certainly a very valuable publication.

There is a possibility that the city hall in Omaha will be supplied with an electric elevator.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, March 28. An interesting proposition comes from August Belmont in connection with the Greater New York agitation. Mr. Belmont proposes to combine the "L" roads of Brooklyn and the "L" roads of New York over the Brooklyn bridge in one gigantic system, to carry passengers over both "L" systems and over the bridge for a single fare of five cents. Thus a man might travel from the Harlem river to Fort Hamilton for a nickel, and when the extension of the Kings County "L" railroad is completed he might go to Coney Island for the same price. The total capital involved in such a deal is $117,598,550. If such an agreement can be made, Mr. Belmont says he can guarantee to Greater New York continuous rapid transit between New York and Brooklyn, without change of cars, for one five-cent fare. To accomplish this mighty undertaking connecting lines would have to be built and the present charter of rapid transit in New York and Brooklyn changed. In this proposition the Manhattan Elevated Railroad company acts in conjunction with Mr. Belmont.

Electrical power will eventually be used on all the elevated roads in New York and Brooklyn. The Bridge experiment has proved a decided success. At the last meeting of the trustees Chief Engineer Martin made the following report:

Since the last meeting of the board I have conducted a series of observations upon the operation of the motor car in use, with the result that it has been determined to use motors of 25 per cent greater capacity than those on the present motor car and to somewhat differently arrange the electrical units in the power house and increase their capacity 20 per cent.

With the equipment increased as shown the plant will readily do the switching of trains running on 45 seconds headway, and in case of failure of the cable, it will be capable of running four-car trains at intervals of 60 seconds. With the transportation equipment, consisting of a double cable, gauntleted tracks, and the above described electrical plant, it seems to me that we shall be in an ideally perfect condition to carry absolutely the maximum number of passengers that the bridge railway can be made to carry. Although even the maximum carrying capacity of the bridge will in all probability never again be equal to or exceed the heavy demands made upon it during the rush hours, it will meet, as far as it is possible for this one bridge to meet, the ever increasing demands for transportation between New York and Brooklyn.

The plant required to put the bridge railway system in perfect condition will be a power house about 100 feet square, engines of a capacity of 2,500 horse power, boilers sufficient to supply steam to them, electrical generators of about 1,600 kilowatts capacity, and with all the paraphernalia of a first-class power house. It is proposed to locate the power house on property owned by the bridge trustees and situated at the corner of Dock and Water streets.

The car equipment will consist of four motors, each of which will be able to exert a drawbar pull of 1,500 pounds, and they will be arranged so that any number of them can be operated independent of the rest. All of the ordinary and welltested devices will be installed to insure certainty and regularity in the operation of the electrical appliances.

I have made an approximate estimate of the cost of the new power house and plant complete and it will be about $300,000. I have made all estimates liberal, and feel sure that the figures given will not be exceeded. This does not include the new cars that will be required. Neither does it include the heating equipment on the cars for heating by electricity. The above estimate provides for the equipment of 20 cars.

At the next meeting the trustees are to submit the plans for the power house and on their approval bids will be at once advertised for. The executive committee reported that the contract for the equipment of 20 cars with electric appliances had been awarded to the General Electric company at $3,645 each.

The Kelsey Electric Railway Specialty company has appealed to the United States Circuit Court of Appeals from the order of Judge Townsend granting a preliminary injunction in favor of the Thomson-Houston company enjoining the manufacture by the Kelsey company of a trolley base. The ground of the appeal is that there is no evidence in the case of the Kelsey company's intention to aid in the infringement of the Van Depoele patent. The Kelsey company was sued for contributory infringement in having manufactured merely the trolley base, which was not covered by the patent specifications.

The daily press gives much space to Tesla's announcement that it may be possible to attract the attention of the inhabitants of the planets if there are any by electrical disturbances originating on the earth and projected through the ether. We know that electric disturbances on the earth in the form of thunder showers," he says "Now, why is it not equally conceivable that a disturbance on the earth's surface should produce some tangible effect on other planets?" He adds that an electrical apparatus having a spark gap of a mile could be made without difficulty. He says that this is the extreme application of the principle of the propagation of electric waves, but that the same principle may be employed with good effect for the transmission of news to all parts of the earth. He thinks that, as the earth is a conductor, an electrical disturbance at one point, causing a change in the equilibrium of the earth's electricity, should be felt at all points on the earth's surface, and might be recorded by properly constructed instruments. It is stated that Mr. Tesla is at present engaged in finishing his calculations and perfecting the apparatus necessary for experiment in this field of investigation, and he hopes soon to be able to show the practicability of his plan.

As the time approaches for the opening of the exposition, to be held in connection with the National Electric Light association convention, contracts for space are being closed more rapidly. The applications already filed call for the 36,000 square feet of space contracted for by the management, and it has been deemed advisable to contract for an additional 10,000 feet. W. F. O.

### Michigan News.

DETROIT, March 27.—Electrical interests in Detroit may be said to be moving steadily and quietly forward. No large contracts have been awarded, but several large establishments will be equipped with electrical apparatus soon. Among this class may be mentioned D. M. Ferry & Co. and the Peninsular Stove company

The Chase Construction company, recently organized here, is a new concern, composed of men of wide experience in the electrical field. The company will give special attention to municipal work and is prepared to rebuild old plants or construct new ones. O. D. Chase, the secretary and manager, is a first-class construction man.

The Michigan Electric company is about to move into new quarters on Woodward avenue, the best business street in Detroit. Its supply store and phonograph parlors will be well equipped.

The Armorite Conduit company is just getting into new quarters, and will soon be turning out iron armored interior conduit that will meet all the requirements of the National Board of Fire Underwriters. This company will furnish the conduit for the Detroit High School building.

Grand Rapids capitalists are interested in a project to connect Grand Rapids, Holland and Grand Haven with an electric railroad. The survey has been made and rights of way secured.

A syndicate comprising H. C. Burk, A. E. Riopelle, Charles W. O'Brien and James T. Keena is interested in a project to build an electric railroad between Detroit and Toledo. Franchises have been secured from Detroit as far as Monroe, nothing having been done as yet between Monroe and Toledo.

The plant of the Bronson Electric company has just been completed by Rheubottom & Bond of Union City, and the officers of the former company think they have the finest plant in the state. A gas engine is used to drive alternating current dynamos. S. W.

### Northwestern Notations.

MINNEAPOLIS, March 28.—The Fox River Electric company has begun work setting poles for an extension of its system from the east sids of Green Bay, Wis., to the west side. Track laying will be begun as soon as the frost is out of the ground.

The Monterey plant of the Bower City Light & Power company of Janesville, Wis., was burned, with two dynamos of 600 lights capacity. The loss is $4,000 to $5,000.

The St. Paul city council has been considering an ordinance requiring the street railway company to give three-minute service on the interurban line from 5 to 7 P. M. on week days, but as the company agreed to give such service after April 1st, the ordinance was deferred.

The Portland Traction company of Portland, Ore., is equipping its cable road to use electric power.

The report of R. E. Ford, electrical engineer on the Albert Lea, Minn., electric light plant, shows the dynamo to be overloaded, the current unsteady and 10 per cent. too low, poor regulation and dirty globes.

The case of the attorney-general against the Light, Power & Railway company of Fond du Lac, Wis., has been decided in favor of the attorney-general. The court holds that the company did not comply with the law, in that while its principal office was in Fond du Lac, the business was directed from Chicago, where all directors' meetings, save one, were held. It is further held that Elihu Colman did not purchase the plant at foreclosure sale as trustee or attorney of the company, but individually and with full understanding and agreement of W. G. DeCelle, as president and attorney of the company, and for that reason the company did not procure the funds to pay the judgment and would lose all title to the property. The decision decrees that the company has forfeited all rights and directs that it be wound up, appointing G. A. Knapp receiver for that purpose.

The loss on the light plant at Stevens Point, Wis., was adjusted at $1,438. The plant will be remodeled and an addition built. The machinery is being rebuilt at Milwaukee.

Electric lights are being agitated at Waukon, Ia.

The D. & D. Electric Manufacturing company of Minneapolis secured the contract to put in a private plant at Mapleton, Minn., for C. H. Brown.

The Fergus Flour Mills have sued the Western Union Telegraph company in St. Paul for $1,320 damages for a mistake in transmitting a telegram. The message was written to buy "ten thousand bushels wheat," but was delivered "two thousand," and when the mistake was discovered the plaintiffs made a demand for the 8,000 bushels of wheat, but were refused and had to buy at 74 cents. They now want the difference between the price at the time the message was sent, 57½ cents, and 74 cents.

The gross earnings of the Twin City Rapid Transit company, operating the Minneapolis and St. Paul car lines, for February was $145,061, against $134,896 for a year ago. Net earnings were $71,678, against $66,945. Gross earnings for two months this year were $303,904, against $286,927, and net earnings for two months were $159,389, against $143,904. C.

### Washington, D. C.

WASHINGTON, MARCH 28.—Sealed proposals are being invited until April 20th for furnishing the signal office of the War Department with a quantity of electrical supplies. Intending bidders can obtain specifications and blank forms of proposal by addressing Gen. A. W. Greely, chief signal officer, War Department, Washington, D. C.

The president has signed the army appropriation bill, which contains a clause making provision for the purchase of supplies for the signal service, telegraphic articles, instruments, etc., to the amount of $18,000.

Morse, Williams & Co. of Philadelphia, Pa., have been awarded the contract for placing one electric passenger elevator in the United States custom house and postoffice at New Haven, Conn., for the sum of $2,935.

Emile Berliner of Washington, D. C., has sold his patent dated August 10, 1886, and covering carbons of any size or shape having a porosity after baking, to the New York Carbon Works of 41 Cortlandt street, New York city.

The joint resolution authorizing the secretary of the treasury to distribute the medals and diplomas awarded by the World's Fair Columbian Commission to the exhibitors entitled thereto has been signed by the president.

The authorities are beginning to open their eyes at the violations of the law prohibiting the stringing of overhead wires. A day or two since a policeman reported that during the night two overhead wires had been strung over Fourteenth street, just north of Rhode Island avenue. This information set the commissioners thinking, and they acted at once. True, no penalty was attached to violations of this character, and the law was practically inoperative. Nevertheless, they believed they could proceed against the lawbreaker under the police regulations, and sent the superintendent of telegraphs and telephones to ferret out the case. With a lineman he followed the illegal wire from pole to pole, until finally the responsible end was located in the office of the Western Union Telegraph company. Orders from District headquarters were issued to take the wire down, and the lineman was prepared to cut it down, but the company promised to remove it, and in a short time the wire was taken away. D. P.

## PERSONAL.

Edward Weston, president of the Weston Instrument company of Newark, N. J., sailed for Bermuda last week for a brief rest.

L. J. Montgomery, secretary of the Electricity Newspaper company, has resigned. He had been connected with *Electricity* since its removal to New York in 1891.

Robert S. Stearnes has severed his connection with the

General Electric company, and is now a member of the firm of Raymond, Stearnes & Gray of New Orleans, electrical engineers and experts.

## ELECTRIC RAILWAYS.

The Chicago & Wisconsin Inland Lakes Railroad company has mapped out electric lines of a total of 225 miles, running from Chicago to Milwaukee and into the lake region of Northern Illinois and Southern Wisconsin. The main line it was proposed to run from Chicago to Madison, tapping Desplaines, Libertyville, Fox Lake, Wilmot, Geneva, White Water, Oakland and Hope. The Milwaukee line, as proposed, was to run from Wilmot, with a line diverging at Muskego Lake and running to Watertown. Another line was proposed from Watertown to White Water, running through Jefferson, with a branch also from Fox Lake to McHenry and one from Geneva to Delavan. The capital stock of the company is $10,000,000, and President Alfred E. Case says that the whole amount of the stock has been placed. Mr. Case announces that the company has secured the old right of way of the Portage & Superior railway, known as Cash & Price's railroad from Desplaines to Libertyville, a distance of 22 miles. He says further that the company is now figuring with the owners of the franchise running from Brown's Lake to Milwaukee, some 40 miles, and also for a franchise under which the company will be able to build lines into Chicago.

J. J. Shipherd of this city, says the *Cleveland Recorder*, one of the gentlemen interested in the United Motor company, which has been conducting a series of experiments in regard to use of storage batteries as a means of propulsion on street cars, stated that he was very well satisfied with the experiments so far made. "The theory is a beautiful one," said Mr. Shipherd, "for the new system would do away entirely with expensive power plants and cumbersome, dangerous overhead wires. You see the system we are working on is not to charge a battery and then let it run down, as has been the method in vogue with most inventors, but we carry a gasoline tank and by manufacturing our electricity on the car are able to keep up the maximum of power with the minimum of expense. Just as long as the gasoline in the tank holds out, just so long we can run. I could not tell you just how much gasoline we can carry, but I do know that there is enough to make power for 24 hours. We have a car running on the Superior street tracks, after the cable stops. The work done is very good so far, and we all believe the method of transmitting power now in use will be superseded by the storage battery in time." Both the battery and motor employed in these experiments were invented by Mr. Washburn of the Ford-Washburn Storelectro company.

## TELEPHONE.

The city council at Terre Haute, Ind., on March 25th refused a franchise for the People's Telephone company, and E. P. Knight, president of the Indiana Harrison Telephone Construction company, which has the right for the Harrison telephones for that state, announced that he would endeavor to form a local company to enter the field in competition with the Bell monopoly. The People's company was organized last fall by Terre Haute capitalists, but the Bell company delayed action until the People's stockholders were doubtful about entering the field. This delay on the part of some stockholders was the excuse for the action of the council.

## MISCELLANEOUS.

The electrical engineer has many enemies, from the teredo, which ruins his submarine cables, to the mice, which devour his electric light mains. It has remained for the English town of Blackpool to furnish a new terror. Blackpool possesses a menagerie, from which there recently escaped a porcupine. When recovered it was found to have devoured the insulation off two cables of a three-wire system and to be desperately engaged on the internal strands. It is not stated how this diet agreed with the animal.

## TRADE NEWS.

Edward C. Talcott, who has been connected with the Jewell Belting company for several years, will hereafter represent the company in Western New York and Pennsylvania. Mr. Talcott has a large number of friends in the electrical business who will wish him continued success in representing a belt so well known as that manufactured by the Jewell company.

General Manager Thomas Wallace, Jr., of the Ansonia Electrical company of Ansonia, Conn., has recently returned from a short trip in the South, where he went to recuperate. This company has been doing a large business of late, with good prospects. The excellence of its manufactures is well known, like the name. Preparations are being made for extending the business to meet the growth of trade.

The O. S. Platt Manufacturing company of Bridgeport, Conn., has completed its organization and is now making a number of changes in its factory plant, especially to meet the growing demand for the New England switch. This switch has passed all the tests of the various insurance boards and has received complimentary notices from construction firms. O. S. Platt is well known as an inventor and skillful mechanic, and will continue in personal supervision of all the company's manufacturing interests, assisted by C. J. Knapp, who has been elected secretary and treasurer.

The many friends of A. L. Millard, the well-known "Electric Appliance man," will be interested to know that he is recovering from his recent spell of illness Mr. Millard has been on the road for the Electric Appliance company, Chicago, for a long time, and his many acquaintance throughout the western territory as well as his numerous friends among his co-laborers "on the road" will be pleased to hear that he will soon be in the field once more.

The management of the American Electrical Works is constantly impressing upon the trade the importance of the old saying that whatever is worth doing is worth doing well. Its latest effort is in keeping with this policy. It has just favored the trade with a neat and attractive catalogue of artistic conception and excellent workmanship. It will be a constant reminder of the methods which Mr. Phillips and his associates employ in all their business transactions as well as social relations.

The fine new catalogue of the Royal Electric company of Peoria, Ill., shows that this enterprising concern is well up to the front in the manufacture of electrical machinery. The Royal alternator, made by this company, is well known, and its advantages are clearly set forth, with meritorious illustrations, in the new catalogue, which also shows switchboards, rheostats, transformers, fuse boxes, etc. The company also makes direct current dynamos and motors, and is prepared to submit estimates on any class of alternating current or continuous current work.

Forée Bain of Chicago is undoubtedly an exponent of "absolutely unbiased expertism," as we are told in an exceptionally attractive and convincing booklet on "Electrical Expertism" which he has just issued. In this brochure uncontrovertible facts are clearly set forth, and the reasons that make wise the employment of an electrical engineer are concisely stated. As to the value of the engineer's services, the writer, addressing the non-technical client, says: "Whatever they may be worth, they don't cost you anything, because the expert engineer saves you losses which you would be certain to have without his advice and his services."

The electrical fraternity will be interested to learn that the Independent Electric company, 153 Lake street, Chicago, is now manufacturing quite extensively bicycle parts and accessories. The tested fuse wire and links of this company are well known to electrical people, and the concern does a large business, in fuse wire in the East as well as the West. In an interview recently the manager, William R. Goodman, spoke with enthusiasm of the steady and rapidly growing business of the company in fuse wire. The Independent Electric company, in addition to its electrical business, has done quite an extensive work in the introduction of a number of novelties. The Whitley exerciser is one of its best known specialties, and this device has met with phenomenal sale. A curious point noticed by Mr. Goodman was that the company has had remarkable success in placing the Whitley exerciser with customers who have heretofore bought nothing but fuse wire. It is needless to say that the company owes its success largely to Mr. Goodman's efforts. He has been indefatigable in pushing for trade, and it is a notable fact that his advertising is seen all over the United States.

A very elaborate report of tests made by the Pittburg Testing Laboratory at the works of the Carrie Furnace company, Keating Station, Pa., to determine the relative performance of Babcock & Wilcox and Cahall boilers, is issued by H. E. Collins & Co. of Pittsburg. The tests were made on January 31st and February 1st on a 250 horse power boiler of each make, under as nearly the same conditions as possible. The report is signed by A. B. Bellows. Blast furnace gas was used as fuel, and all the conditions are exhaustively described. The laboratory company, in its "general remarks," says: "It is interesting to note from the results given in the tabulated report that while the B. & W. boiler evaporated more water, it did so with a much greater heating surface, and when the two boilers are compared on an equal basis of heating surface, the Cahall, notwithstanding it had less gas, evaporated more water per square foot of heating surface. * * * * We have tested quite a number of different makes of boilers, and all our experience has been that the Cahall can make steam on the smallest amount of waste gases, which, of course, is due to the high efficiency which it develops as shown by tests made by different independent engineers." In the "tabulated results" appended it is stated that the B. & W. boiler evaporated 3.35 pounds of water per hour per square foot of heating surface, while the Cahall evaporated 3.54 pounds. The percentage of total calorific power utilized is placed thus: B. & W., 54.45 per cent.; Cahall, 76.89 per cent.

## BUSINESS.

L. A. Chase & Co., 161 Fort Hill Square, Boston, show by an illustrated pamphlet how complete are their facilities for electrical manufacturing and repair work. The workmen, machinery and facilities are all of the highest grade.

J. D. McIntyre, with the Pass & Seymour company of Syracuse, N. Y., was in Chicago recently. Mr. McIntyre is making a tour of the western states in the interest of his company, and has met with flattering success. He has secured many orders for the goods manufactured by his company, which are widely known.

The American Engine company of Bound Brook, N. J., announces that Frank H. Ball, the well-known steam engine designer, has assumed the management of its business, and will add at once a full line of his engines, especially designed for direct-connected electrical work and adapted to dynamos of the American Engine company's manufacture, thus making complete and symmetrical units

The Shawmut Fuse Wire company of Boston has recently opened a western office in Chicago at 100 Washington street The office is in charge of Morris Metcalf, who will be remembered as the former manager of the company in Boston Mr Metcalf states that his company is making the best and cheapest station switches on the market and that it expects to do a large business in them throughout the West.

The Electric Appliance company has just completed the successful installation of an electric light and power plant in its own building at 242 Madison street, Chicago. The power is secured from a powerful natural gas engine, which also does the work of driving a large freight elevator. The plant is running nicely and producing a satisfactory light, It is needless to say that the dynamo is splendidly assisted in accomplishing its results by the use of Paranite wire and Packard lamps. The switchboard is equipped with C. E. M. jack-knife switches and Whitney instruments,

Word has been received from President Burroughs of the American Battery company, Chicago, that he has just closed a contract with General Joseph Torrence for sixty 600 ampere-hour cells for lighting his private residence. The American Battery company reports also a rapidly increasing business and one that affords the company much encouragement as to the future. The storage battery business of the United States has been narrowed down to a few concerns, placing the American company in an enviable position to secure a large share of the western business. For years the American company has dealt in storage batteries, and has unquestionably mastered its business, so that it is now producing a battery for which the best results are claimed.

The Akron Electric Manufacturing company, Akron, Ohio, has just about completed a 1,000-light plant for the Diamond Match company of Liverpool, England. Recently, in conversation with Manager H. A. Palmer, a representative of the WESTERN ELECTRICIAN learned that this was the fourth plant that the company has sold to the Diamond Match company. Taking into consideration the fact that this immense corporation has for years bought its electrical machinery from no other concern, it is needless to say that this speaks well for the merits of the Akron company's dynamos. Engineer Charles L. Pisel of the Diamond Match company recently, in a letter to Mr. Palmer, wrote that "the whole system, from dynamos to lamps, indicates the high standard your company has reached in electrical machinery and construction work." He added: "I believe it to be far above the average. This plant has stood the criticism of the highest authority and has been complimented by all." Such words as these need no comment. In addition to the above, the Akron company is about to make a shipment to Pittsburg of a 25 horse power motor to be used in the office of the *Pittsburg Chronicle*. This makes the fifteenth machine which the Akron company has running in Pittsburg.

The new American Electric Heating corporation of Boston is already busily at work in its field. "Cooking and Heating Appliances" are very attractively illustrated and described in a pamphlet just issued, in which it is stated that the electric heater is bound to supersede all older methods of obtaining artificial heat. The great advantages of electrical heat are enumerated, while the absolute safety in using the current in improved appliances is pointed out. The company has a most complete and varied line of apparatus for electric heating, including ovens, cooking utensils, chafing dishes, curling tongs, heaters, sad-irons, portable air heaters, glue pots, immersion heaters for melting pitch, etc. Slate or marble cooking tables are delivered with all necessary screws, bolts, etc., ready to put together, only requiring the placing of the plugs and switches and the connecting wiring. There being no smoke or fire, no chimney is required, therefore the cooking table can be fitted in any convenient place to which wires can be carried, and may be removed at will by simply disconnecting the wires. They are furnished in two sizes, one with a working surface 30 inches long by 22 inches wide, with back slab 10 inches high for switches, and the other with a working surface 48 inches long by 26 inches wide, with back slab 20 inches high. The latter size has also a shelf 48 inches long by nine inches wide, giving that much more cooking surface without taking any additional room. These appliances can be used on either direct or alternating current and are constructed for the required voltage, therefore the character of the current and the voltage should be stated when ordering.

Edwin S. Reid, who has been with the Standard Underground Cable company for many years, as superintendent of construction, has severed his connection with that company and has accepted a position with the National Underground Cable company, with main office at New York and branch offices at Chicago, Philadelphia and Boston, as its general superintendent of construction, and all construction work done by the National company will be under his immediate charge and supervision. Mr. Reid, who was for many years associated with S. D. Field in his various electrical works, entered the underground cable business in its earliest days, and many of the appliances used on underground cable work, which have tended to make underground cables successful, are of his invention and design. There are but few

underground systems in the United States which Mr. Reid has not had something to do with, and his experience covers not only the construction of cables, but also the building of complete subway systems; and besides he has the advantage of being able to make the most delicate and complicated electrical tests, and of being master of electrical subjects generally. The National Underground Cable company has just received an order from the West End Street Railway company of Boston covering all the lead-covered underground feeder cable to be used by the latter company during the year 1896. The first work to be done on this contract will be for about 21 miles of 500,000 circular mil cable and two miles of 1,000,000 circular mil cable. The West End company has been using, for some time, large quantities of the National company's cable, and the giving of this order speaks for itself as to the quality of the cable and the satisfaction it has given.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued March 24, 1896.*

556,763. Telephone Switch. William A. Moore, Brooklyn, N. Y. Application filed September 5, 1895.

The combination in a telephone switch of one or more contact points, a finger lever, a sliding hook, an elbow lever interposed between the finger lever and the sliding hook, and positive continuous connections from the finger lever to the elbow lever, and from the elbow lever to the sliding hook.

556,769. Electrode for Secondary Batteries. Oscar Firsch, Liege, Belgium. Application filed March 11, 1895.

A conductive core for storage battery electrodes constructed of thin sheet lead and provided on both faces with projections having tubular projections, having radially diverging and overhanging teeth or branches, the rows of projections on one face substantially occupying the space between the rows of projections on the opposite face.

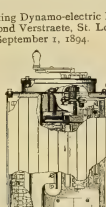
556,782. Secondary Battery. Max Sussmann, Neu-Ruppin, Germany. Application filed May 15, 1895.

This is an electrode for secondary batteries, comprising a sheet metal conductive core and an active material consisting of a paste composed of a plumbic material and pumice stone in a finely divided state, and a solution of rubber.

556,854. Conductor for Electrical Decomposing Tanks. John Leith, St. Helen's, England. Application filed November 20, 1895.

The system of electrolytic installation described comprises a series of tanks for the electrolyte, divided into positive and negative cells arranged alternately, and comprising conductors leading to and from the generator, the wires from which conductors are severally connected to the anodes and cathodes of the first and last tank respectively of the series, the cathodes of the first tank being coupled to the anodes of the second tank, and the cathodes of the second tank to the anodes of the third tank, and so on throughout the series.

556,788. Operating Dynamo-electric Machines in Multiple. Edmond Verstraete, St. Louis, Mo. Application filed September 1, 1894.



NO. 556,862.

A generator having series field coils and field coils in shunt relation to the armature, and another generator supplying the same circuit in multiple, having a set of shunt field coils energized by current taken from the opposite sides of the armature of the first generator are employed.

556,823. Automatic Grounding Device for Electric Conductors. George A. Jewett, Chicago, Ill. Application filed July 8, 1895.

The invention comprises a suspended electric conductor and a support, to which the wire is attached, and a spring-arm secured to the support and resting at its outer end against the wire, electrical connections between the spring-arm and wire, and a stationary part electrically connected with the ground and terminating in close proximity to the spring-arm, the latter being adapted to move into contact with the stationary part when unsupported by the wire.

556,862. Controller for Electric Motors. Edward D. Priest, Schenectady, N. Y. Application filed April 9, 1895.

A controller for electric motors is described, comprising means for connecting the motors in series or parallel and varying the resistance in circuit to suit the conditions of running, such means being operated by movement of the controller handle in one direction from a position in which the circuit is open, and means for controlling the motors by the rheostat alone, such means operated by the movement of the handle in the opposite direction from its open-circuit position.

556,864. Trolley Support. Emil B. W. Reichel, Gross-Lichterfelde, Germany. Application filed September 3, 1895.

Yieldingly pressed levers pivoted to stationary supports, and a pivoted trolley arm carried upon the ends of the levers, and springs for imparting to the trolley arm a tendency to occupy a vertical position are features of the invention.

556,865. Alternating Current System. Edwin W. Rice, Jr., Swampscott, Mass. Application filed January 24, 1894.

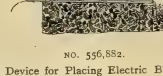
The arrangement includes a dynamo-electric generator having a winding so disposed and connected as to generate and deliver currents to single-phase and multiple-phase circuits, and a regulator for the dynamo responding automatically to changes of potential in the single-phase circuit.

556,866. Electric Elevator. Edwin W. Rice, Jr., Schenectady, N. Y. Application filed April 2, 1890.

The last claim follows: The combination with the electric controlling or regulating devices, of an arm connected thereto and provided with an anti-friction wheel at its free end, a strap-brake operating upon a drum on the armature shaft, and the operating lever for said brake provided with a cam surface concaved at its middle to receive said wheel.

556,876. Clip for Trolley Wires. Ralph H. Beach, East Orange, N. J. Application filed April 17, 1895.

Two clamping members are provided at both ends and intermediate the latter with corresponding projections or lugs having pivotal connection to unite the members, grooved along their lower edges to receive the trolley wire between them, and also formed along their upper edges with tapering grooves to receive between the members a securing device, and a tapering securing rod or pin fitting the tapering grooves, and having bearing within the grooves at both ends of the members, as well as intermediate the ends, to prevent the springing of the members.



NO. 556,882.

556,882. Device for Placing Electric Blasting Fuses. Robert H. Elliott, Birmingham, Ala. Application filed July 13, 1895.

In an igniting device for use in blasting, the combination is claimed with an electric fuse, of flexible wires connected to the fuse, and covered with flexible insulating material for a short distance from the fuse, and a rod made of insulating material and inclosing the portion of the wires adapted to fit within bore-hole and terminating a short distance from the fuse.

556,893. Electric Car Truck. Emil Lundqvist, Pittsburg, Pa. Application filed July 31, 1895.

The inventor claims in an electric locomotive the combination of a motor solely supported on the truck frame, a gear wheel rotatively mounted in a bearing in the motor frame and in mesh with a pinion on the motor shaft, an axle connected with the gear through a flexible joint, consisting of a loose sleeve surrounding the axle, one end of which is flexibly coupled to the gear wheel and the other similarly coupled to the axle, the gear and sleeve having a clearance all around the axle sufficient to allow the axle to move freely in all directions.

556,898. Electric Arc Lamp. George C. Pyle, Indianapolis, Ind. Application filed May 2, 1895.

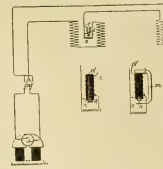
A bar mounted parallel with the upper electrode, a clutch mechanism at its upper end to hold the upper end of such electrode, a ring extended from the lower end to support such electrode at its lower tapering end, and an extension down from such sliding-bar insulated from it and provided with means for holding the upper end of the lower electrode in place.

556,902. Electrical Detonator. Charles H. Rudd, Chicago, Ill. Application filed February 3, 1894.

One claim is given: The combination with explosive material of fusible conductors for igniting the same included in an electric circuit in series, and a shunt or by-path around or of said fusible conductors for carrying current to the conductors last to fuse, and means for preventing the falling of the current below the proper strength as the resistance of the circuit is increased by the fusing of the igniting conductors.

556,903. Electrical Detonator. Charles H. Rudd, Chicago, Ill. Application filed February 3, 1894.

The features of this invention shown in the cut include the combination with explosive material of the igniting conductor *r*, the piece *m* of magnetic material, soft iron core *d*, helix *e* included in a parallel circuit with the igniting conductor, armature *h* and the fusible material *k*, the core *d*, armature *h* and fusible material *k* being situated between the ends of the piece *m*.



NO. 556,903.

556,904. Electrical Detonator. Charles H. Rudd, Chicago, Ill. Application filed February 3, 1894.

The combination with explosive material as claimed of heating coils and an igniting conductor in a common electrical circuit, and means for passing the heating current through the heating coils and an igniting current through the igniting conductor.

556,941. Trolley Attachment for Electric Cars. Fred S. Smith, Hartford, Conn. Application filed June 11, 1895.

One claim is for the combination with the trolley arm and its pivot of a rod pivoted to the trolley arm and a support through which the same passes, a cross-head sliding on the rod, and a hook carried by the cross-head, and springs acting upon the cross-head, a pawl upon the trolley arm to engaging the hook, a flanged wheel at the end of the trolley arm to bear against the elevated conductor, and mechanism intervening between the flanged wheel and the pawl for holding such pawl and for liberating the same when the flanged wheel does not bear upon the conductor.

556,945. Regulating Device for Controlling Working of Electromotors. René Thury, Geneva, Switzerland. Application filed February 8, 1896.

This is a device for controlling the speed of an electromotor, and for putting the latter into circuit as an electric brake in electric railway cars, characterized by the combination of only one hand-lever, with a segmental rack acting on the one hand upon a pinion bearing two switch arms and on the other hand by means of its arm *s* pon the forked arm of a switch, in combination with the external contact pieces and internal contact pieces, which are disposed concentrically to the axis of the pinion, in view of putting into the circuit of the electromotor a variable number of resistances, and the contact pieces disposed concentrically to the axis of the switch, in view of reversing the direction of the electric current in the induced coil of the electromotor.

556,946. Electric Signal Lamp. Alexander F. Ward, Memphis, Tenn. Application filed June 21, 1895.

A signal device comprising a dynamo, a hand-driven mechanism therefor, and an inclosing protective casing, in combination with a folding mast carried by the dynamo casing and a signal lamp at the upper end of the mast, comprises the outfit.

556,967. Electrical Connector. Philip H. Fielding, New York, N. Y. Application filed July 9, 1895.

A stage or floor pocket is described, consisting of a tube of insulating material set into the floor or wall, having a free passage through it and provided, nearly with electrical contacts located against opposite sides and in different planes, so as to be diagonally opposite each other, in combination with a plug of insulating material adapted to enter the tube and provided exteriorly with bands of conducting material adapted to contact respectively with the contacts in the tube.

556,971. Insulated Support for Contact Rails. Augustus Hanson and James R. Chapman, Chicago, Ill. Application filed October 30, 1893.

NO. 556,967.

Insulated supports are employed, comprising each a standard or base, and rail support mounted thereon and insulated therefrom; guard planks carrying keys or wedges and vertical slots provided upon the rail supports for the reception of the keys or wedges are also provided.

556,987. Electric Recording Instrument for Ships' Compasses and Logs. Charles L. Jaeger, Maywood, N. J. Application filed January 25, 1894.

The inventor claims a combined recording compass and log, comprising in its structure a magnetic needle, means for uniformly feeding a strip of paper, conductors arranged on opposite sides of the strip and influenced by the magnetic needle for recording the ship's course, a make-and-break contact actuated by the log mechanism, conductors in connection with the make-and-break contacts, and arranged on opposite sides of the strip for indicating the distance sailed, an induction coil and electrical connections.

557,008. Electric Trolley. George R. Mitchell, Newtown, Pa. Application filed November 22, 1895.

In an electric trolley the combination is claimed of a supporting arm, a current-collecting device carried at the free end of the arm and adapted to make a running contact with the under surface of a suspended conductor, a flexible guide frame also carried at the free end of the arm and extending to the front and to the rear of the current-collecting device, and grooved guides carried upon the free ends of the flexible guide frame, whereby they are respectively arranged to the front and to the rear of the current-collecting device.

557,015. Trolley for Electric Railways. Patrick F. O'Shaughnessy and Oscar W. Crosby, New York, N. Y. Application filed September 27, 1888.

The invention comprises a trolley for making an underneath contact with a conductor, a telescopic support for the trolley on the roof of the car, and means operating within reach of the operator for adjusting the trolley.

557,047. Electrical Connector. Benjamin L. Toquet, Westport, Conn. Application filed December 28, 1895.

This is a joint for electrical conductors consisting of a tube fitting over adjoining end of the conductors, both tube and conductor ends being indented, widened and crushed together at points.

557,094. Converter of Frequency for Alternating Electric Currents. Maurice Hutin and Maurice Leblanc, Paris, France. Application filed March 13, 1894.

This method of transforming an alternating electric current of one periodicity into an alternating current of another periodicity consists in successively and continuously changing the point of connection in either direction around a commutator apparatus.

Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, APRIL 11, 1896. No. 15

## Railroad Station Lighting Plant at Syracuse, N. Y.

The thriving city of Syracuse, N. Y., is now adorned by a railroad station which is, perhaps, large and handsome enough to atone for the dinginess, discomfort and inconvenience of the old station, which the town outgrew many years ago. The station was built by the New York Central & Hudson River Railroad company, which owns the principal railroad traversing the city, and has just been completed. The building for the passenger station and local offices is a picturesque structure of pink granite, with brown stone trimmings and a Spanish tile roof. It is 170 feet wide by 124 feet deep, and the exterior and interior are respectively distinguished by a massive tower and a rotunda 90 feet square and 60 feet high. The adjacent train-shed is 482 feet long and 128 feet wide, with steel trusses 32 feet apart having a span of 108 feet. The station was designed by Bradford L. Gilbert of New York, who also planned the Illinois Central station in Chicago, and a perspective view is given in the smaller illustration on this page.

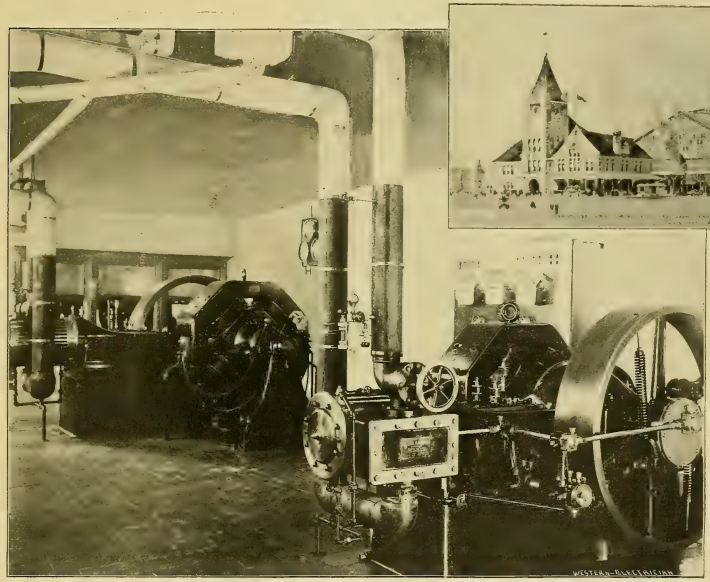


FIG. 1. RAILROAD STATION LIGHTING PLANT AT SYRACUSE, N. Y.—ENGINE-DYNAMOS AND EXTERIOR OF BUILDING.

Under the tracks in the train-shed is the power and lighting plant, the electrical portion of which is illustrated herewith. Three boilers are installed, and two are constantly in use. Each boiler stands on four upright supports of its own, without any shell of masonry. Effective packing is obtained by magnesia covering, so that little heat is radiated, and the temperature of the boiler room rarely, if ever, rises above 70 degrees. The auxiliary steam plant of pumps, feed-water heaters, etc., is very complete, and especial attention is paid to neatness and attractive arrangement, so that the plant affords an interesting spectacle to passengers passing through the adjoining subway. The exhaust steam is used for heating, although reducing valves are provided to use the "live" steam for this purpose if necessary.

The engine-dynamo units are shown in the picture. There are two of them, each consisting of a Ball & Wood simple engine and an Eddy four-pole 115 volt dynamo. One of the dynamos has a capacity of 75 kilowatts and the other is rated at 25 kilowatts. Connected with the lighting circuits are 1,200 incandescent lamps, 30 Waterhouse & Gamble low-tension arc lamps and two small Eddy motors. The arc lamps are in the train-shed. The rotunda is very effectively lighted by 500 incandescent lights disposed in stucco and plaster work and also in beautiful fixtures especially designed by Oxley & Enos of New York, the whole producing a very pleasing effect. Other artistic fixtures are found in the restaurant, waiting-rooms and offices. The switchboard, which is of marble, is shown in Fig. 2. It has the usual equipment of switches, rheostats and instruments. The wiring is in iron conduits throughout and shows an average resistance to ground of over one megohm. Simplex insulation is used.

This plant was started on October 1st last, and has been operated continuously ever since, the feeders never being without current day or night. Not a single accident has occurred, and the entire installation has proved eminently smooth-running and satisfactory. The installation and equipment was done by Gustave Monrath & Co. of Chicago for the Eddy Electric Manufacturing company of Windsor, Conn.

## National Electric Light Association.

The sessions of the convention of the National Electric Light association, which will be held in New York next month, will be in one of the large rooms in the Industrial building, Lexington avenue and Forty-third street. The hotel headquarters will be the Murray Hill Hotel, Park avenue and Forty-first street, within two blocks of the convention hall. Prices to delegates, $2 per day and upward on the European plan; $4 and upward on the American.

The following list of papers has been arranged by the committee:

Single-phase Self-starting Synchronous Motors By F. H. Leonard.

Results Accomplished in Distribution of Light and Power by Alternating Currents. By W. S. R. Emmet

Acetylene Gas. By Louis A. Ferguson.

Evolution of the Arc Lamp. By L. H. Rogers.

Steam Boilers: Their Equipment and Management. By Albert A. Cary.

Electrolysis. By William Brophy.

Evolution of Interior Conduits: From an Electrical Standpoint. By Luther Stieringer.

A general discussion on the "Desirability of a Standard Socket" will be opened by Alfred Swan. Another special feature will be a lecture by D. McFarlan Moore on "The Light of the Future."

Other topics will be discussed, as the committee has been in communication with several gentlemen who have signified a willingness to prepare papers, but the subjects have not yet been announced. This feature of the meeting will undoubtedly be in keeping with the rest of the arrangements.

## New Method of Studying the Light of Alternating Arc Lamps.[1]

By William L. Puffer

Somewhat more than a year ago I wished to demonstrate to the senior class in electrical engineering, during a lecture I gave them on alternating current phenomena, that, although when examined by means of a large projected image upon a white screen in a darkened room, the alternating current arc appeared to be as steady as the direct current arc, and the light was thrown equally upward as well as downward, yet there were very great fluctuations in the light due to the intermittent heating of the carbon points.

The method chosen was the stroboscopic, which has given us at the [Massachusetts] Institute of Technology most excellent results in the hands of various experimenters while investigating the movement of transmitter electrodes, telephone diaphragms, tuning forks, vibrating strings, and the like.

A hand regulating arc lamp was placed in a lantern.

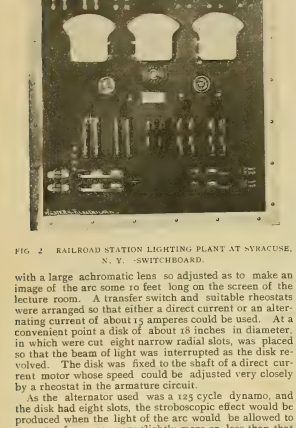


FIG. 2. RAILROAD STATION LIGHTING PLANT AT SYRACUSE, N. Y. -SWITCHBOARD.

with a large achromatic lens so adjusted as to make an image of the arc some 10 feet long on the screen of the lecture room. A transfer switch and suitable rheostats were arranged so that either a direct current or an alternating current of about 15 amperes could be used. At a convenient point a disk of about 18 inches in diameter, in which were cut eight narrow radial slots, was placed so that the beam of light was interrupted as the disk revolved. The disk was fixed to the shaft of a direct current motor whose speed could be adjusted very closely by a rheostat in the armature circuit.

As the alternator used was a 125 cycle dynamo, and the disk had eight slots, the stroboscopic effect would be produced when the light of the arc would be allowed to pass at a frequency very slightly more or less than that

$$\frac{125\times 60}{8}$$

of the dynamo, or $\frac{125\times 60}{8} \times 937\frac{1}{2}$ revolutions per minute of the motor armature.

Suppose, for example, it ran at 937 revolutions per minute, then, counting from the time when the current in the arc was zero each receding flash of light would be $\frac{1}{16}$ part of a complete alternation behind the preceding one, and owing to the persistency of vision the arc would be seen on the screen, as if the alternations had been so reduced in speed that it took two seconds for a single alternation of the current.

An attentive watching of the image as the current alternates is now highly interesting and instructive, and can only be seen to be fully appreciated.

It is clearly shown that the alternating current arc is a sequence of direct current arcs, alternating in polarity, and that each wave of current produces very clearly and distinctly all the attributes of the direct current arc.

The hot positive carbon with its white-hot crater, from which extends the fan-shaped blue light of the arc to the small white tip of the colder negative carbon, will be seen to die away, and all light goes out except the glow of the red-hot carbons, and then light appears again with the current reversed.

Early in November last the subject was again taken up, with the very efficient aid of R. R. Lawrence, a post graduate student in electrical engineering at the Massachusetts Institute of Technology, and rapidly developed with such beautiful results that it was decided to exhibit publicly before the Society of Arts, which has done some little while after, at the regular meeting of January 2, 1896.

We first attempted to take a set of instantaneous photographs of the arc at different periods of an alternation, and by the use of a pneumatic shutter, and a progressive motion of the lens, obtained some very sharply defined pictures. After many trials, this was given up, because of the practical impossibility of timing the exposures with respect to the alternations, and we decided to use a disk with half as many slots as there were pole-pieces on the dynamo, and to drive it by the shaft of the machine itself.

The dynamo available was one giving a three-phase 960 volt current with a frequency of about 120 cycles. Two wires only were used to give us the current required.

1. Abstract of paper read before the American Institute of Electrical Engineers, New York, March 6, 1896.

A somewhat long, light shaft, carrying at one end the disk, and at the other a positive mechanical clutch, was mounted in line with the armature shaft. As the clutch could only be thrown in when the two shafts were nearly equal in speed, a small motor was placed so as to bring the disk up to speed when the clutch was thrown in and the motor belt removed.

The disk was held in place by a frictional clamp disk on the shaft. A graduation and reference mark served to measure angular inclination of the disk or shaft, wherefore of slots with reference to the pole-pieces or alternation of the current.

The arc to be tested was put in a boxing to keep away air from the currents close behind the disk, and a camera with a roll holder in front of the disk. With this arrangement the arc as seen was perfectly steady at any part of the wave that corresponded to the position of the disk on the shaft, and as the process of stopping, setting and starting the disk was very rapid, the roll holder being in meantime turned, many pictures could be taken in a very few minutes.

Generally it was not necessary to take more than 12 exposures in order to get a series showing clearly the changes in light intensities during a single phase.

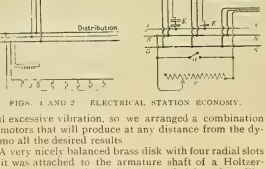
We found that it was about as instructive to watch the appearance of the arc on the ground glass of the camera, and far more beautiful. In this way we examined both the effect produced in the arc by change in the voltage of the circuit, the current being kept constant by alteration of the resistance.

For example, with 500 volts, and a large non-inductive resistance in series with the arc, it was plainly evident that the current wave was approximately sinusoidal, as the time of extinction of the current, as indicated by the blue band of the arc proper, was very short, and the rise and fall of the current gradual and with no irregularities. This is to be expected, as the back electromotive force of the arc is small compared to the voltage of the generator, and the circuit as a whole is non-inductive.

The opposite condition was realized by using a lower electromotive force and regulating by a reactive coil. The time of no current was longer, and the current appeared to jump to its maximum in an exceedingly small angular time. In this case the arc was not steady, showing clearly to the eye that the succeeding waves of current were not alike either in form or current value, and also that the angle of lag was constantly changing. This fact has always prevented an accurate plotting of wave forms by the instantaneous contact method, and, although known to exist, was never before actually seen.

A very pretty double arc was arranged by using three carbons and wiring two circuits, each with current regulators, in such a way that the arc was the common junction, and one carbon was of one polarity, while the other two of the opposite polarity. With wire resistances in each side, there was nothing peculiar to be noted other than the effects of the junction of two currents, but when the resistance in one circuit was gradually cut out, and equivalent inductance cut in, there was at once the evidence of the lag of the current, together with the change of shape of the wave and the unsteadiness before noted. Owing to the long time of no current in the inductive side there were times when even with considerable lag there were actually no visible traces of current between either point. This effect was dependent on adjustment of current strength and inductance as well as voltage. The sequence of currents and polarity in this arc was most beautifully brought out when the disk was disengaged from the shaft, and driven by the little motor at a rate very slightly less than the dynamo.

We found that work in the immediate vicinity of the dynamo was not very desirable, owing to air currents




FIGS. 1 AND 2 ELECTRICAL STATION ECONOMY.

and excessive vibration, so we arranged a combination of motors that will produce at any distance from the dynamo all the desired results

A very nicely balanced brass disk with four radial slots in it was attached to the armature shaft of a Holtzer-Cabot synchronous induction motor of eight poles. The pulley of this motor could be driven by a light belt from a self-starting induction motor of the same make, which is, however, not quite synchronous under load. By trial the two pulleys are wound with rubber tape until their ratio is such that the brass disk will be uniformly driven at a speed a trifle above synchronism, and the arc light can be seen through the slots to pass through the alternation at a desirable rate.

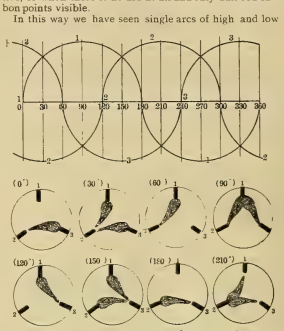
By a single movement of a switch, the non-synchronous motor is cut out, and the synchronous cut into circuit when the armature drops into step with the dynamo, and the arc is instantly seen as fixed, the belt is thrown off or left on, as desired. These armatures may be on the same shaft, if necessary. The synchronous motor does not stand on its base, but rests on the turned outside of its bearings in pillow blocks, which are attached to a suitable base frame

Concentric with the shaft and firmly attached to the motor is a brass gear, six inches in diameter, and on it a graduated circle. On a lever pivoted so as to be thrown to or from the motor gear is a small spur gear with a milled head for turning.

Turning this head will evidently cause the motor to slowly rotate about its axle, and as the armature must be in step with the dynamo, and as the turning of the motor changes the position of a given pole piece relatively to the arc light, it follows that any part of the alternation of current in the arc may be seen on the screen, and as the motor has eight poles, a quarter turn, or 90,° on the graduated circle corresponds to a complete cycle in the arc.

The picture of the arc can then be photographed, measured, or in any way studied at leisure in any phase relation, as, for example, when the top carbon is positive, or when there is no arc at all and only dull red carbon points visible.

In this way we have seen single arcs of high and low




NEW METHOD OF STUDYING THE LIGHT OF ALTERNATING ARC LAMPS.

electromotive-force, long and short double arcs, arcs with much inductance in circuit, Jablochkoff candles, arc between a ring and a point within, the spinning arc between the ends of a carbon cylinder and a concentric carbon within, with a magnetizing coil around the inner carbon and the like.

One of the most beautiful arcs investigated by us visually and photographically was a rotary arc made by the use of three carbons in the same plane, at angles of 120° apart and wired up as the junction point of an external **Y** load on a 500 volt 60 cycle three-phase generator. Non-inductive resistance was used in the circuit, and the current used in one leg of the **Y** was 10 or 15 amperes.

Twelve photographs were taken at equal intervals of 30° in an alternation of the current in one wire. The cut shows very clearly the relation of the current waves from the different carbon points, and the curved, fan-shaped figure indicates the position and direction of the bluish arc at the corresponding angle. The base of the fan rests on a positive carbon which has a white-hot crater and all the appearance of the positive carbon of a direct current arc, while the tip of the fan rests on the white spot at the end of a negative carbon.

It will be seen at 0°, for example, there is no current on carbon 1 and that 2 is negative and 3 positive, the blue fan-like arc curving from 3 to 2; 30° later, 2 is still negative and 3 positive, but that an equal arc is now playing from 1 to 2. At 60°, 2 is still negative, 1 positive, but there is no current on 3. At 90° the appearance is somewhat like 30°, except that the signs are changed, and the point with the double current is necessarily much whiter, it being now positive. And so on through the changes of the complete wave.

This three-phase arc, when seen while the disk is running non-synchronously, is the most beautiful of any studied, and may be seen according to the different length of arc and the divergence of the disk from exact synchronism, either as a band of blue light which seems to be progressively traveling over the three sides of a triangular path, or as a rapidly spinning star of blue light, being in fact a rotary arc.

The three-phase arc is less noisy than the single phase, and its light is steadier and has less variation in its total intensity, owing to the fact that the current never stops, and there is always a positive carbon. Three cored carbons, placed parallel side by side, with slight magnetizing coils to keep the arc at the ends of the carbon, will give a very satisfactory light in the direction away from the tips, and may be used when it is desirable to throw the light all in one direction.

Four carbons at 90° apart, each with a suitable resistance in series with it, and connected to quarter-phase tap wires on a Gramme ring or other generator giving quarter-phase circuits, will also produce a rotary held arc of great beauty and interest

Study of these arcs is still going on at the Institute of Technology under my immediate charge, which will, I hope, produce results sufficiently interesting to justify a second paper at some later date.

## English Pumping Station Operated by Alternating Motors.

An interesting application of electrically transmitted power has recently been made by the English town of Worcester, where alternating current motors have been installed in the city waterworks for the purpose of operating the pumping machinery.

As these pumps were to be used throughout the day, it was thought they would materially help the day load of the station, especially as the turbines were designed to take up the whole of the light load. The waterworks are some distance from the electric lighting plant, and special high tension mains have been carried there. The current is then transformed by means of two 30 kilowatt transformers to 100 volts, at which pressure the motors are arranged to work.

There are at present two three-throw horizontal plunger pumps, with rams six inches diameter and 15-inch stroke, each set being capable of pumping 10,000 gallons of water per hour against a vertical head of 300 feet, through 5,000 yards of 10-inch pipe, at a speed of about 45 revolutions per minute. Each set is fitted with a second motion shaft, spur wheel and pinion, and fast and loose pulleys with striking gear complete. The pumps are placed side by side upon a strong cast-iron bedplate of sufficient length to take the driving gear. Each pump is fitted with brass suction and delivery valves, and glands and stuffing boxes bushed with brass. The pump rams are of close grained cast-iron, turned and fitted with guide, shoes and steel pins. The two motors which are employed are each capable of developing 30 brake horse power, and are of the alternate non-synchronous type, running at about 500 revolutions per minute. The accompanying cut gives a comprehensive view of the equipment.

The motors, after being started and put to work, require very little attention; indeed, it is claimed to be no uncommon thing for the pumping room to be left and locked up for a considerable time. On one occasion, according to the London *Electrical Review*, a caller at the waterworks, finding no one about, proceeded to the pumping room, which he found locked. Looking through the glass door, however, he could discern the motors working away merrily.

## Texas Gas and Electric Light Association.

The second annual meeting of the Texas Gas and Electric Light association will be held at Dallas on May 12th and 13th, at which time the following papers will be presented:

"Electric Light Companies and Their Consumers," by L. T. Fuller of Calvert.

"Fixed and Variable Expenses in Manufacturing Plants," by Thomas D. Miller of Dallas.

"Our Association," by A. E. Judge of Tyler.

It is understood that Mr. Bauer of Texarkana, Mr. Cullinane of Denison, and Mr. Lord of Fort Worth, will present short papers. The following named gentlemen comprise the committee of arrangements: Thomas D. Miller, H. L. Monroe, J. C. Lord. Nothing will be left undone for the comfort and convenience of members and visitors. This committee will make all necessary arrangements as to details of programme for both days, secure headquarters and look after hotel rates. A large attendance is anticipated. The present officers of the organization are: W. E. Holmes, Austin, president; P. Bauer, Texarkana, vice-president; Homer Starr, Gonzales, secretary and treasurer. The executive committee includes L. T Fuller, C. D. Brann, J. H. Fitzgerald, Thomas D. Miller; finance committee, C. D. Brann, J. H. Fitzgerald, L. T. Fuller.

## Electrical Topics for Scientific Bodies.

Judging from the published proceedings of scientific bodies in all parts of the country, electrical subjects continue to attract the attention of experimenters, and interest in these investigations is constantly extending to a larger number of students. This fact is particularly impressed upon those who follow the proceedings of the Franklin Institute by the *Journal* for April, which is devoted exclusively to contributions upon electrical subjects. The first paper presented is a consideration of "The Röntgen Rays," by Edwin J. Houston, Ph. D., and A. E. Kennelly, Sc. D., with discussion by Prof. A. E. Dolbear, Prof. Elihu Thomson, Dr. Joseph W. Richards, John Carbutt, Prof. C. F. Himes, Prof. M. B. Snyder, James Wilson and others. Another interesting contribution is Pedro G. Salom's article on electric carriages. There is also a paper by Maurice Barnett on "The Evolution of the Storage Battery," which is discussed by C. J. Reed.

## Electrical Station Economy.

Dr. Rasch, in *L'Industrie Electrique*, says that capital invested in electric lighting alone is not properly utilized. The showing of the best month, December, is taken too often as a standard, and used as a basis for financial statements. The depreciation and interest on the original investment, added to the expense of administration and salaries, form the greater portion of the maintenance cost, for the expense of the production of the current itself is relatively small in comparison.

Great effort has been made to save in the utilization of material; the tariff for motor current has been reduced, but the minimum price of to-day, 31 centimes per kilowatt hour, is still above the reach of small industries, and even worse for those who require large machines. A very material reduction in rates, coupled with a binding clause preventing the use of current, except when the lighting demand is least urgent, has been attempted.

But an arrangement like this only imperfectly reaches the difficulty, for a hardship is worked upon the consumer who is compelled to open his switch at four o'clock in winter and cannot avail himself of power current after dark at any time.

And, again, there is a manifest injustice in according a rebate to consumers of current for one purpose while refusing it to another—to charge more for light than for power, especially when the former demands as much current by day as by night. Of this class examples are cafés, restaurants and hotels. It is unjust to ask for what purpose current is needed; it is only fair to consider the hours of the day when current is used.

It would be of advantage in some central stations to fix the normal price of energy for the time from 4 to 10 P. M. in winter, and 8 to 10 P. M. in the summer, and to reduce the price considerably during the balance of the 24 hours, and this would not interfere with the commercial demand for electrical energy.

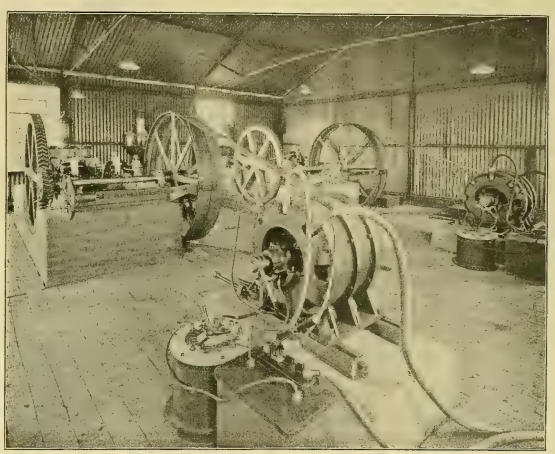
This general line of practice has been adopted at Ipswich, England, where each consumer has two meters, one of which registers the day and night consumption, and the other the evening consumption. At the proper time all the meters are manipulated so as to record the current used at the other rate. In some installations this change is made by a clock attachment.

These arrangements are somewhat complicated, but the system here suggested, which depends on a meter in which the indications are proportional to the tension at the extremities of the fine wire spool, may be found interesting. If the meter is attached in the ordinary manner, that is to say, if the coarse wire spool is in the subscriber's line and the fine wire spool is placed between the two conductors, the tension which acts upon this is the total tension and the apparatus indicates the total consumption. But nothing prevents submitting this fine wire to a tension which can be regulated at the central station. To accomplish this a second wire, calculated for feeble currents only, is necessary. These secondary lines are single-pole lines, and the pilot wires of cables may be utilized, arranged as for telephone purposes.

Fig. 1 will show how this may be done, by connecting the fine wire spool to the principal line, and to the secondary, as shown, all the meters being connected similarly. The secondary lines terminate at a distribution bus-bar *ss* of the switchboard, Fig. 2. This bar is connected across a resistance *r*, to one of the principal bars *ss* of the board. When this resistance *r* is short-circuited the fine wire spools of all the meters are actuated by the normal tension of the station.

During the evening hours when the meters should show the entire consumption, the resistance *r* is in short-circuit. It is recommended that an interrupter be put in parallel with this resistance, so placed that tampering with the arrangement is impossible.

The regulation of *r*, which changes with the modifications of the tariff and when several new meters have been placed, is easily accomplished through a voltmeter which is placed in derivation upon the fine wire spool, and which should bear the same relation to the mean tension of the circuit as the reduced tariff bears to the maximum tariff.



ENGLISH PUMPING STATION OPERATED BY ALTERNATING MOTORS.

As for example, if the maximum tension is 170 volts with a normal price of one franc and a minimum price of 20 centimes per kilowatt hour, the resistance *r* should be regulated so that the voltmeter would show a tension of one-fifth the normal pressure, thus:

$$\frac{110 \times 20}{100} = 22 \text{ volts.}$$

This arrangement is applicable to the two-wire system, but it is clear that it may be made to fit either a three or five-wire installation.

As shown by the following analysis, in most cases it will be found that pilot wires or others of one square millimeter section will have sufficient capacity.

Suppose we have an installation on the three-wire system, covering 500 meters, supplying 35 consumers with a total of 1,000 incandescent lamps. The copper for a fall of two volts will require to be 480 millimeters square for each of the principal conductors. The fine wires of the 35 meters, which absorb each $\frac{1}{10}$ of an ampere (Siemens & Halske or Aron), are connected between the intermediate cable and the special conductor, having a section of one millimeter square. This will then cause a fall of potential of 2.4 volts, or 2.2 per cent.

Hence, we see that under unfavorable circumstances it is possible to produce a proper difference of tension in the fine-wire circuit.

Let us see what are the advantages which this system presents. But first, let it be understood that these fig-

ures are based upon every-day practice when it is assumed:

First—The maximum tariff is applicable to the consumption of current in winter from 4 to 10 P. M., and in summer from 8 to 10 P. M., an average of from 6 P. M. to 10 P. M., forming a total of 1,460 hours per year of 365 days, at one franc per kilowatt hour.

Second—That the minimum rate (20 centimes per kilowatt hour) is applicable to the other hours of the day.

Third—To determine the amount of rebate, the mean hours of lighting are found by dividing the meter record in kilowatt hours by the power installed. In other words, suppose that our rebate table allows six per cent. on 750 to 1,000 hours' consumption, 10 per cent. on 1,000 to 1,500 hours' consumption, 15 per cent. on 1,500 (or over) hours' consumption.

*First Case.*—Lighting the entire night.

Meter record: P kilowatts are consumed during 4,300 hours, 1,460 of which pay the maximum rate and 2,840 pay the minimum rate.

$$P\times 1{,}460+P\times\left(2{,}840\times\frac{20}{100}\right)=2{,}028\ P.$$

Mean duration of lighting, 2,028 hours. Rebate, 15 per cent.

Cost: $P\times 2{,}028\times 0.85=P\times 1{,}724$ francs. Actual energy: $P\times 4{,}300$ kilowatt hours. Actual price of kilowatt hour $\frac{1{,}724}{4{,}300}=0{,}400$ franc.

*Second Case.*—Lighting during the day. Say that in a café there are 30 lamps installed, consuming 1.5 kilowatts. These burn 300 days, from 8 A. M. to noon, and from 10 2 to 8 P. M., or, in all, 3,000 hours per annum, of which only 600 hours are amenable to the maximum charge, while the remaining 2,400 hours are only chargeable at the minimum rate.

Record of the meter:

$$1.5\times\left(600+\frac{2{,}400\times 20}{100}\right)=1{,}620\text{ kilowatt hours.}$$

Mean illumination: $\frac{1{,}620}{1.5}=1{,}080$ hours.

Rebate, 10 per cent. Cost: $1{,}620\times 0.9=1{,}458$ francs. Actual energy: $3{,}000\times 1.5=4{,}500$ kilowatt hours. Actual price: $\frac{1{,}458}{4{,}500}=0.324$, or 1.62 centimes per lamp hour of 50 watts.

*Third Case.*—A concert hall is lighted three times per week from 8 to 11 P. M., or three hours, of which two pay the full tariff. The meter shows:

$$52\times 3\left(2+\frac{100}{20}\right)=343\text{ hours for each kilowatt installed.}$$

In fact there are $52\times 3\times 3=468$ hours. The average price will consequently be:

$$1.00\ \frac{343}{468}=73\text{ centimes per kilowatt-hour}$$

*Fourth Case.*—A restaurant is illuminated by 80 lamps, consuming a total of four kilowatts. The energy consumed is regulated thus: *a*, from dark to 8 P. M., one kilowatt; *b*, from 8 to 11 P. M., four kilowatts; *c*, from 11 P. M. to 1 A. M., two kilowatts. The meter registers for the entire year:

| | | |
|---|---|---|
| From dark to 8 P. M | 708, | 1 k w. max.= 708 k w. hours |
| From 8 to 10 P. M. | 730, | 4 k.w. max.=2,920 k w. hours |
| From 10 to 11 P.M. | 365, | 4 k.w. min.= 292 k w. hours |
| From 11 to 1 A.M. | 730, | 2 k.w. min.= 292 k w. hours |
| Total | | 4,212 k. w hours. |

Dividing the energy by the kilowatts installed (four kilowatts), we have the mean duration of illumination, 1,053 hours. The consumer then is entitled to a rebate of 10 per cent., and hence will pay at the rate of 90 centimes per kilowatt hour: $4{,}212\times 0.9=3{,}800$ francs. But the patron has in fact consumed $708\times 1+(730\times 4)+(365\times 4)+730\times 2=6{,}318$ kilowatt hours, and he pays $\frac{3{,}800}{6{,}318}=$ 60 centimes, or 2.9 centimes per lamp hour of 50 watts.

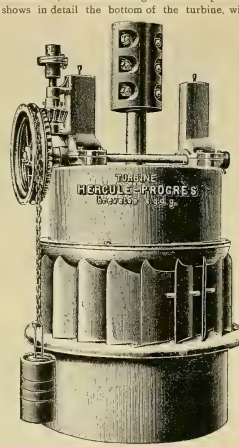
Each example given can be applied to similar conditions in all cases, and it cannot fail of impressing itself up on a consumer and its adoption should add to the list of patrons many who under another system could not afford the luxury of electric current.

Now see another anvantage: It is clear that the consumer, from motives of proper economy, will profit by the minimum rate, and use his motor power as far as possible when it will cost the least money, which will of course be the hours when current is in least demand

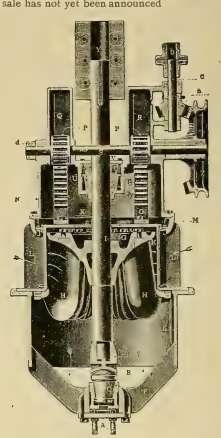
## The "Hercule-Progres" Turbine.

It has been very truly said that to be a good electrician one should be a good mechanic, and it is proper to add an expert in hydraulics. The number of water-driven dynamos is daily increasing. The practice abroad is in some respects considered by some experts in advance of this country's. The "Hercule-Progres," for moderately high waterfalls, say from 25 to 30 meters, is pronounced one of the most satisfactory turbines that has yet been put on the foreign market, according to *L'Electricien*.

This turbine is shown complete in Fig. 1 and in section in Fig. 2. Of the centripetal type, it partakes also of the reactionary and of the parallel types, the water passing radially from the inlets *L*, Fig. 2, upon the wheel *H*. It then follows a deviation of 90° and descends parallel to the axis, acting by its specific gravity on the undershot paddles below. The flow is controlled by a gate *K*, formed like a ring, which moves vertically between the inlet *L* and the wheel *H*. This gate is connected with two gears, *O O*, which mesh into the pinions *P P*, these last being governed by an outside bevel gear *a*; on the same shaft is seen a pulley *Z* with a chain and counter weight balancing the weight of the gate. This is all governed from the deck above by the intervention of an endless screw, the shaft *b* being continued upward. Fig. 3 shows in detail the bottom of the turbine, with its




General View.



Sectional View

FIGS 1 AND 2. HERCULE-PROGRES TURBINE.

spoon-shaped discharge gates, which is at once an element of great strength as well as an additional function in the applied power. Fig. 4 shows still more distinctly the reactionary surface of the discharge paddles. Fig. 5 shows the great strength and compactness of the several parts.

Its peculiar form renders it available in either a pit or quite near the level of the supply. The guaranteed efficiency is 80 to 85 per cent. At full flow a turbine furnished the government has, on test, shown 90.4 efficiency of the theoretical power of the waterfall, and 72 to 76 per cent. with half head.

## Lord Kelvin's Jubilee.

The following communication on the subject of the "jubilee of the Right Honorable Professor Lord Kelvin" has been received by the National Electric Light association from John Caird, principal and vice-chancellor of the University of Glasgow, and Sir James Bell, Bart., lord provost of Glasgow:

In the autumn of this year the Right Honorable Lord Kelvin completes the fiftieth year of his tenure of the chair of natural philosophy in the University of Glasgow. An event so rare in academic history naturally calls forth the heartiest congratulations of the university and the city, but, in view of his pre-eminent position as a man of science, it has been thought fitting that other bodies who have already testified their appreciation of Lord Kelvin's distinction by enrolling his name among their members should be invited to take part in the proceedings with which it is proposed to celebrate the jubilee of his professorship.

We are desired by the committee charged with the arrangements to intimate that the university and the municipality would be gratified by your appointing a representative to take part in the celebration to be held here on the 15th and 16th of June next. Be so good as send to Professor Stewart, clerk of senate, the University, Glasgow, not later than 10th April, the name and address of your representative, in order that a formal invitation may be forwarded to him.

President Wilmerding has named T. C. Martin of New York as the representative of the association and that gentlemen has accepted the appointment.

## American Bell Telephone Company's Annual Report.

[From the Boston correspondent of the WESTERN ELECTRICIAN.]

On March 31st the annual meeting of the stockholders of the American Bell Telephone company was held at Boston. There was an attendance of about 120 shareholders, among whom were two or three women.

The shareholders unanimously authorized the board of directors to increase the capital of the company from $21,500,000 to $23,650,000 and the number of shares from 215,000 to 236,500, an increase of 10 per cent. At par value the new stock will be worth $2,150,000 and will be sold at auction according to law. The date of sale has not yet been announced

Two years ago the Legislature of Massachusetts authorized the Bell company to issue additional stock to the par value of $30,000,000. At that time the capitalization of the company was $20,000,000. Since then two issues have been made up to date, one of $500,000 in November, 1894, and one of $1,000,000 in 1895. The amount authorized to-day brings up the total of new stock floated on the legislative grant to $4,150,000. Prior to the legislative grant there had been two other increases in the capital of the company—one of $2,500,000 in 1891 and another of an equal amount in 1892.

President John E. Hudson was unable to preside, owing to a severe throat affection, and Director William H. Forbes was elected president pro tem. Charles E. Hubbard was re-elected clerk and William R. Driver treasurer. The old board of directors was also re-elected.

President Hudson's report contained tables showing the output of telephones from 1884 to the close of the year 1895, and exhibiting the consolidated statistics of licensees. The number of instruments in the hands of licensees under rental on December 20, 1884, was 325,574, and on December 20, 1895, 674,976, showing an increase over the preceding year of 92,470, and an increase in eleven years of 349,402, or more than 100 per cent.

From another table the following statistics are taken, showing the condition of the company's equipment on January 1, 1896: Exchanges, 927; branch offices, 686; miles of wire on poles, 260,324; miles of wire on buildings, 12,861; miles of wire underground, 184,515; miles

of wire submarine, 2,028, total miles of wire, 491,728, total circuits, 247,847, total employes, 11,090, total stations, 281,695.

The estimated number of exchange connections daily in the United States, made up from actual count in most of the exchanges, is 2,351,420, or a total per year of about 757,000,000. The number of daily calls per station varies in different exchanges from 2 to 16⅔, the average throughout the United States being 8¼, which shows a slight decrease from last year in the average use made of the telephone by each subscriber, due to the introduction of the measured service system. The average cost to the subscriber varies, according to the size of the exchange and character of the service, from less than one to 10.2 cents per connection. On the first of the year extra territorial and toll lines included 52,873 miles of pole lines, an increase of 3,549 during the year, and 215,087 miles of wire, an increase of 35,130. The average daily number of toll connections was 51,123, or a total per year of about 16,400,000; the toll revenue reported by all companies for the year 1895 was $2,940,444.40 (not including earnings of the American Telephone & Telegraph company). Earnings of extra territorial lines included in this sum amounted to $1,311,029.51; of which last amount the American Bell Telephone company received $148,694.47, an increase over 1894 of $41,755.01.

Other tables are presented showing by cities the number of miles of underground wires in use. New York leads with 38,986, Chicago following with 20,352. Boston has 15,687; Philadelphia, 10,999; San Francisco, 8,031; Cincinnati, 7,641; Brooklyn, 7,255; Pittsburg, 6,499; Cleveland, 5,638; Detroit, 5,415; Louisville, 5,317; Milwaukee, 5,262; Baltimore, 4,342; Washington, 3,621. St. Louis has only 44 miles placed to her credit, the work of burying telephone wires in that town only having been begun during the last year. The American Telephone & Telegraph company operated 1,264 miles of underground wire last year.

The following abstract from the report will prove of particular interest to telephone men:

The last year has been one of unprecedented growth in the output of instruments, in the number of exchange subscribers, and in the mileage of wire, whether used for exchange purposes or for toll lines. The number of telephones outstanding on the 20th day of December, 1895, exceeded the number outstanding on December 20, 1894, by the sum of 92,470—much more than twice the gain in any previous year, and about three times the average yearly gain. This stood, too, for an increase in the number of subscribers of 38,263 on January 1, 1896, as compared with the year previous. But not only has the business increased with such great strides during the year, but the tendency to turn itself into the best class of service, metallic circuit, has continued without abatement, or rather has increased in rapidity. January 1, 1896, finds the total number of metallic stations 94,747, being a gain during the year of 40,067 over the number with which the year began. In connection with this fact should be noted the increase of 33 per cent. in the number of toll line conversations, the metallic circuit subscribers being large users of that class of service.

In the Long Distance company's system there were on January 1, 1896, in operation 5,804 miles of pole line and cables and 90,251 miles of wire, connecting 149 offices, an increase during the year of 1,187 miles of pole line and cables, 14,695 miles of wire and 14 offices.

In all there are 29 companies reached (by the Long

FIG. 3. HERCULE-PROGES TURBINE.—OLD AND NEW PADDLES.

Distance company) whose systems furnish our long line terminals. These companies report a total of 201,987 stations, of which 78,755 (38.99 per cent.) are connected by metallic circuit. And of these 78,755 stations, 20,173 are equipped with long-distance cabinet sets.

The Long Distance company had invested up to December 31, 1895, in line construction, franchises, equipment and supplies, $11,435,055.02. The company shows an increase in gross earnings in 1895 over 1894 of 31.1 per cent., the amount for 1895, gross, being $1,326,683.80. It will be remembered that the gross earnings for 1894 were $1,011,961.82; for 1893, $892,361.62; for 1892, $643,436.77.

The introduction, in many of the larger cities, of the measured service system, to which reference was made in preceding reports, has been productive of good results in bringing the service within the reach of many who, not having occasion for large use of the exchange connection, did not feel justified in paying the rates which would entitle them to unlimited service.

During the year the companies leasing our instruments expended for new construction, $6,464,000, for addition to real estate, $315,000, and for repair and reconstruction, $7,224,000, making a total of $14,151,000 applied to extension and care of the telephone plant in the United States.

The latest statistics, derived from official reports and scientific journals, give the entire number of telephone stations, of all classes, in Continental Europe as 300,809. These countries have populations aggregating more than 300,000,000 people, and do not include Portugal, Greece and Turkey, where the business has been but little developed. In the United States, having a population of 62,622,000, there are 308,751 exchange and private line stations operated by licensees of this company. Great Britain, with a population of 38,105,000, has 89,095 telephone stations of all classes.

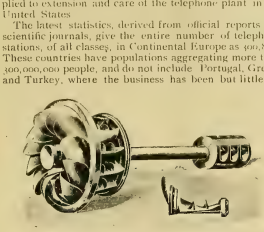


FIG. 4. HERCULE-PROGRES TURBINE.—TURBINE PROPER FROM BELOW.

The following tabulated statement by the treasurer, showing ledger balances December 31, 1895, and the comparative statement of expenses and earnings for 1894 and 1895, were appended:

LEDGER BALANCES DECEMBER 31, 1895.

| | | |
|---|---|---|
| *Debtors.* | | |
| Telephones | $ 1,285,946.63 | |
| Real estate | 1,045,926.86 | |
| Stocks | 44,121,680.95 | |
| Merchandise and machinery | 14,054.66 | |
| Bills and accounts receivable | 3,463,213.83 | |
| Cash and deposits | 1,337,892.83 | |
| *Creditors.* | | |
| Capital stock | | $21,500,000.00 |
| Capital stock, premium account | | 1,398,435.00 |
| Debenture bonds 1888, | | 2,000,000.00 |
| Bills and accounts payable | | 1,120,616.01 |
| Patent account (profit and loss) | | 12,713,809.16 |
| Profit and loss | | 6,349,444.13 |
| Reserve | | 4,035,399.83 |
| Surplus | | 2,151,011,61 |
| | $51,268,715.76 | $51,268,715.76 |

"Of this amount $967,500 is for the dividends payable January 15, 1896, to stockholders of record December 31, 1895.

COMPARATIVE STATEMENT OF EARNINGS AND EXPENSES.

| | 1894. | 1895. |
|---|---|---|
| *Earnings.* | | |
| Rental | $2,502,992.17 | $2,125,359.05 |
| Dividends | 1,937,057.77 | 2,523,149.61 |
| Commission from ex-terr. Lines | 106,939.46 | 148,694.47 |
| Commission from teleg. business | 29,352.96 | 32,422.65 |
| Real estate | 69,675.09 | 76,175.50 |
| Interest | 196,455.11 | 215,320.06 |
| Miscellaneous | 5,172.38 | 3,831.49 |
| | $4,848,244.94 | $5,124,952.83 |
| *Expenses.* | | |
| Expenses of operation | $ 430,340.29 | $ 495,611.87 |
| Legal expenses | 178,342.58 | 132,754.73 |
| Real estate | 35,798.34 | 37,452.70 |
| Interest and taxes | 356,478.51 | 245,536.83 |
| Commission | 459,958.71 | 296,284.36 |
| Royalty | 5,000.00 | 1,152 03 |
| Concessions | 231,713.64 | 649,500.41 |
| Miscellaneous | 26,827.59 | 2,592.37 |
| | $1,724,459.87 | $1,911,193.30 |
| Net earnings | $3,123,785.07 | $3,213,759.53 |
| Surplus acc't, Dec. 31, 1894 | $2,151,011.61 | |
| Net earnings, 1895 | $3,213,759.53 | |
| | | $5,364,771.14 |
| Regular dividends, 1895 | $2,502,453.00 | |
| Extra dividends, 1895 | 630,000.00 | |
| Reserve for unadjusted acc't | 81,306.53 | |
| | | 3,213,759 53 |
| Surplus acc't Dec 31, 1895 | | $2,151,011 61 |

## The Edison Fluoroscope.

Prof. W. M. Stine of Armour Institute of Technology, Chicago, contributes the following: "The writer is under obligations to Messrs. Aylsworth and Jackson for a fine fluoroscope designed by Thomas A. Edison and manufactured by them at Orange, N. J. This piece of apparatus embodies the results of Mr. Edison's investigations on the Röntgen phenomena, and is a very valuable contribution to the practice of the new art. It consists of a pyramidal shaped wooden box with an opening at the apex wide enough to admit the eyes. The opening is fitted with a leather visor, faced with chenille along the edge, the visor being so shaped as to fit snugly around the eyes and prevent access of all light. The box is neatly covered with black cloth, and provided with a convenient handle. It strongly reminds one of the old-style stereoscope. The large end is six inches square and is covered with a stout piece of pasteboard, the screen proper. This is heavily coated on the inside with a layer of fine-grained and beautifully regular crystals of calcium tungstate, presenting a resemblance to a piece of emery or sandpaper. The calcium tungstate is prepared by fusing sodium tungstate with lime in the presence of sodium chloride as a flux, and the resulting mass purified by thorough washing. Mr. Edison carefully examined a large number of chemical compounds, and it was in the course of these investigations that he discovered the highly fluorescent property of calcium tungstate to the Röntgen rays.

"The apparatus was immediately tested, with very gratifying results. When held near the active portion of the bulb of a Crookes tube, the screen lights up with a singularly beautiful white light. On one test a brass-bound two-foot rule was placed on the screen. All the metal parts, and even the graduations, were clearly visible; the wood was entirely transparent, showing the rivets with great distinctness. The handle of a screwdriver proved equally transparent. Coins in a purse were easily seen, and similar objects covered with notebooks, etc. Very weird effects are obtained when the hand or arm is placed on the screen. The bones show with considerable clearness, and one may readily follow their movements when the fingers are moved.

"This type of apparatus seems capable of much improvement in sensitiveness to the Röntgen rays. Its applications to surgery are obvious, and in this connection a multitude of applications are suggested. The results do not compare in sharpness with the sciagraphic negative and prints. Every photographer knows how vastly the negative exceeds in detail the image on the ground-glass screen. The fluoroscope may be very properly compared with the ground-glass screen of the camera, and will play in sciagraphy much the same part which the glass screen does in photography.

"Comparisons were at once made between the calcium tungstate and the barium platinum cyanide screens, and showed the superiority of the former. In the absence of any means for the measurement of fluorescent light, no exact ratio can be stated, but it may be safely estimated that calcium tungstate is several times the more sensitive. The fluoroscope is the development of a class of apparatus that has been in use for some time, and employed it some years since. Professor Röntgen discovered the fluorescent property of barium platinum cyanide and used a screen coated with this chemical in his memorable investigations. Professor Salvoni covered the end of a tube with such a screen and called it a cryptoscope. A. C. Swinton and other European experimenters have used the same device. In this country the screen in some form of tube has been employed by nearly every scientific experimenter. Mr. Edison, with his usual practical bent, has given us a most compact and convenient apparatus and the most sensitive screen yet made. As the matter is of such wide interest to the medical profession, and even to the general public, we propose to thoroughly test the capabilities of the screen. Those investigators who have the facilities and leisure should devote their energies to the double metallic

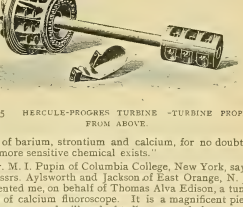


FIG 5 HERCULE-PROGRES TURBINE —TURBINE PROPER FROM ABOVE.

salts of barium, strontium and calcium, for no doubt a still more sensitive chemical exists."

Dr. M. I. Pupin of Columbia College, New York, says: "Messrs. Aylsworth and Jackson of East Orange, N. J., presented me, on behalf of Thomas Alva Edison, a tungstate of calcium fluoroscope. It is a magnificent piece of apparatus and will undoubtedly prove of the greatest service in the new field of work opened up by Röntgen's discovery. I cannot speak too highly of its merits, and I take much pleasure in recommending it to all who are interested in Röntgen radiance. I wish to state also that this recommendation is spontaneous and not in any way suggested or even hinted at by the generous donors.

"Mr. Edison and his assistants, Messrs. Aylsworth and Jackson, deserve the deepest gratitude on the part of scientific men and the public at large for their magnificent fluorescent screens."

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## HIGH WATER MARK

CIRCULATION, 16,630.

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THE publication offices of the WESTERN ELECTRICIAN have been removed to much more commodious quarters. Our new address is Suite 510 Marquette building, Dearborn and Adams streets, Chicago.

The telephone number remains unchanged—Main 1746.

COMMENTING upon the proposition that the great industrial enterprises of the country be taken out of the hands of private capitalists and placed under governmental control, because of the apparent tendency of the present owners to effect combinations and otherwise conduct them prejudicial to the interests of the public, the [illegible] this suggestion.

[illegible] observed how our legislative [illegible] to the City Council, man- [illegible] pretty well satisfied that if [illegible] the mines and the railroads [illegible] would not be run in [illegible] than they are now [illegible]

[illegible] corroborated by the state [illegible] which the experience of a well-known electric light man with the city council and city electrician of a town in Michigan is related. The article gives a fair idea of the conditions existing in many communities to-day and the methods employed by the advocates of municipal lighting. The writer has not drawn upon his imagination and he has not exaggerated the conditions, as any experienced electrical man will readily testify.

Chicagoans have an object lesson constantly before them in the city lighting plant. No better example could be suggested, as it proves conclusively how little dependence can be placed upon the promises of politicians like John P. Barrett, who, upon the plea of saving money for the city, induced the corporation to authorize his department to establish a street lighting plant. A greater mistake was never made by any municipality. We do not know of any other city in the country where such conditions as prevail in the street lighting department of the city of Chicago would be tolerated.

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IT has become the fashion to speak of the press of the country in terms of pity and contempt, because of the supposed inaccuracy of everything published that pertains to science and engineering. It may be true, and in fact there is indisputable evidence, that some of the great daily newspapers of the larger cities very often disregard the proprieties and sacrifice truth and accuracy in order to make a sensational yarn. But the newspapers that do this are certainly few; in fact, they are insignificantly small in number by comparison with the great number of reputable journals that strive constantly to add to the sum of human knowledge, and for this reason the condemnation should not be made in general terms, but each particular case should be considered separately and decided upon its merits. Very often it is the case that the newspaper is made the victim of some designing projector or inventor who concocts a yarn that will attract public attention to his scheme. When investigation proves the absurdity of the claims advanced, the man who is really responsible for the publication of the articles, the alleged inventor, is the first to disclaim knowledge of authorship, and in many cases he goes so far as to denounce the newspapers through which circulation was given to the "fakes" which he in reality perpetrated. It seems to be regarded as legitimate enterprise nowadays by a certain class to take up some man who has already accomplished something of value or has given promise of great things and attribute all sorts of achievments to him. We have had several exhibitions of this sort in electrical circles of late, but we are pleased to note the general disapproval that these announcements have met. The electrical fraternity is not devoid of professional honor, and those who have offended in this way have been made to feel the displeasure of their associates.

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THE management of the National Electrical Exposition, to be held at New York next month, has given out a list of the individuals, firms and companies that have secured space for exhibits. The secretary announces that as many more concerns have filed applications for as much more space as has already been alloted, but that arrangements have not yet been completed with these applicants. Less than a month remains before the opening of this exhibition, and it behooves intending exhibitors to complete their arrangements at once. This applies particularly to the western concerns that have not closed their contracts for space. Most of the representative houses have filed applications, and there is no question that they will be represented, but they should bear in mind the fact that much preparation and labor will be required to make a creditable showing, and unless attention is given the subject at once they will find themselves at a disadvantage. The trouble seems to be that the western houses, in fact all of the companies outside of New York and the immediate vicinity, do not realize the importance and the magnitude of the exhibition of this year. It will not be like those of former years, when there was scarely any organization and when the exhibits were scattered over hotels and public buildings. This exhibition will be carefully arranged, compact and well ordered, and the products of different manufacturers will be so placed that comparison may be possible. It will insure more attention to every exhibit and give to each concern additional importance. This will unquestionably be the largest and most attractive electrical exhibition that has ever been conducted under the auspices of the National Electric Light association or the American Street Railway association. Both of these organizations, the recognized representatives of their respective industries, have favored this exhibition with their unqualified approval, and the general public will take advantage of the opportunity thus afforded to examine all that is new and meritorious in the way of electrical apparatus of the present day. It should be borne in mind, too, that the attendance will not be entirely local, but, on the contrary, there is every indication that the convention to be held during the exposition will be far better attended than any other in the history of the National Electric Light association. There will be a large western delegation, comprising representatives from all the leading electrical interests of this section, and this fact alone should be sufficient inducement to manufacturers to contribute to the success of the exposition.

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ACCORDING to the annual report of the American Bell Telephone company that corporation continues to thrive in spite of opposition, competition and the general depression which has so seriously affected other commercial enterprises. Copious extracts from this report are presented on another page, and a study of these would indicate that the company is actively engaged in extending its field, improving its service and fortifying its position in every possible manner. Reference to the financial statements which accompany the report indicates that the extension of the business was not accompanied by a proportionately large increase in the net receipts of the company. This may, in part at least, be explained by the policy of the Bell interests in attempting to crush out competition by furnishing free service temporarily, or at least charging only a nominal rental for the instruments. Another contributing cause is the fact that what is known as the limited service, which is being furnished to residences in many cities, gives a much smaller return than the regular commercial service. Mention is made of the government suits against the Bell company, but no new light is thrown upon these proceedings. The Berliner case will come up for argument before the Supreme Court of the United States upon appeal of the government on October 19th, and until that tribunal passes judgment nothing can be done by the Bell interests under this patent. A feature of the report that will be appreciated is the numerous tables and the statistics presented. The Bell company has refrained heretofore from disclosing information concerning its equipment and the volume of its business, and very little reliable data of this character has been made public. It has been known that the company possessed splendid equipment, but definite and authentic information has not been obtainable excepting by those who were directly connected with the management. It is only necessary to mention one feature of construction to convey an idea of the magnitude of the Bell enterprise and the advancement that has been made during the last ten years, and it may be remarked incidentally that this is fairly representative of the progress that has been made in other departments. On January 1, 1886, the work of burying telephone wires can be said to have only just been begun. At that time, according to the records of the Bell company, this class of work was confined to seven cities, namely, New York, Chicago, Washington, Pittsburg, Milwaukee, Boston and Brooklyn and the total mileage of underground wire was 3,417. To-day there are 80 cities included in the list and the total number of miles operated by the Bell interests, including the Long Distance company, amounts to 185,845, which is, by the way, an increase of 30,253 miles over the previous year. This fact alone shows the rapid development of the telephone interests in this country. It may be interesting to note that each of the cities already mentioned as having underground telephone wires in 1886 has to-day in operation a greater number of miles than the total of the entire country ten years ago. When it is understood that corresponding advancement has been made in other lines the importance of the telephone interests will at once be apparent. It should be borne in mind, too, that to-day there are in the telephone field independent companies whose business aggregates a considerable amount, and these concerns are rapidly extending their business, putting in new exchanges and building up a system that bids fair to rival the Bell plant. This is especially true throughout the West and Northwest, where competition has been welcomed and encouragement given to these independent companies everywhere. That they, too, have adopted a high standard of apparatus and construction is apparent, as they have successfully introduced their instruments in many places that heretofore have been considered Bell strongholds.

## The Anode Fallacy.

By W. M. Stine

In the last issue of the Western Electrician the writer described some experiments which satisfactorily mapped out the whole generating area of the tube, and in this connection pointed out that the ray was generated by the cathode stream, and was not a phenomenon of the anode. So persistently has the anodic claim been reiterated by many experimenters, that a further search has been made to discover a basis for the error. The investigation of the action of some induction coils has given an indication of its origin. The Crookes tube here employed was the one described in the above article. In one case it was excited by a small coil capable of giving a three inch spark. It was noticed that the characteristic cathodic fluorescence appeared not only opposite the cathode, but also to a marked extent opposite the anode. The tube was then transferred to connections with a much larger coil, and excited with the same primary electromotive force. In this case no fluorescence was noticed opposite the anode. It was again connected to the smaller coil and the condenser to the coil was increased by the addition of an auxiliary one of several microfarads. As the latter condenser was an adjustable one, the effect of added capacity could be closely watched. As additional capacity was placed in circuit the fluorescence opposite the anode increased, while that opposite the cathode diminished and at length disappeared, showing that the polarity of the tube had become completely reversed. The conclusion is obvious, when the action of the induction coil as a step-up transformer is considered. The office of the condenser to an induction coil is two fold. It serves to decrease the spark at the interrupter and thus increase the rapidity of the interruption of the primary circuit, and at the same time, by reason of its oscillating discharge, plays an important part in accelerating the magnetic flux in the core. When the capacity of the condenser is properly adjusted to the coil, the polarity of the secondary coil is practically constant. If the capacity is much above or below the proper amount, the secondary electrodes will to that extent show an alternating polarity. This was the case with the small coil first tested. Its polarity alternated with the make-and-break of the current, but the electromotive force on making was less than on breaking the current. As a result, each electrode of the tube was in turn the cathode, and the cathode effect less opposite the stronger anode. The adjustment of the capacity of the condenser is made with reference to a certain speed of the interrupter, and this adjustment will not usually hold for higher speeds. For this reason but little is gained by using an interrupter run at a high speed on the primary circuit.

The function of the condenser in connection with the induction coil is clearly explained in Professor Carhart's "University Physics", vol. II., p. 389, and Fleming's "Alternate Current Transformer", vol. I., p. 383.

A careful review of the technical press, to say nothing of the newspapers, shows that more fallacies than facts about the Röntgen phenomena are being reported. This condition is not only confusing the lay reader, but misleading many scientists. If experimenters would take more pains to inform themselves of what has already been done, there would not only be less tiresome repetition but fewer errors committed.

## Sciagraphs as Legal Evidence.

The X-ray has already found its way into the law courts, and there is promise for an excellent field of application in actions for damages, growing out of cases of personal injuries, and in similar practice. The first case in this country is reported from Wichita, Kan., where it was determined to introduce this innovation in a case in the United States District Court. The press dispatches say that Lucien I. Blake, professor of electricity in the University of Kansas, was selected to take a sciagraph of the wrist of Peter Noel, who had brought suit in the United States District Court against the Atchison, Topeka & Santa Fé Railroad company for $10,000, claiming that the company's physician damaged him to that extent by bunglingly setting his fractured wrist. The sciagraph secured by Röntgen rays will be introduced in evidence, both plaintiff and defendant having agreed to accept it as final evidence.

Another case is reported by cable from London, under date of March 30th:

The Court of Appeals of the supreme court of judicature, the highest judicial tribunal in this country, is to pass upon the legality of admitting as evidence testimony based upon the application of the Röntgen rays, and its decision will be of moment to the medical and legal fraternity throughout the world, inasmuch as an affirmative judgment would be tantamount to legalizing the new discovery as competent evidence in litigation and would establish a precedent that would doubtless be followed in other countries. The case will come before the court in the form of an appeal by the Nottingham Theater company, which was recently mulcted in $5,000 damages in the suit of Gladys Ffolliott, an actress who sustained injuries by falling through a dilapidated stairway in the theater. The plaintiff's case was weak until the production of negatives of her left foot, taken by Professor Ramsay by means of the new rays, which clearly demonstrated that the bones of the foot had been seriously displaced. With this evidence before it, the jury promptly gave her a verdict and the theater company appealed.

This is the first time that testimony based upon the X-rays has been offered in court, and the fact that it was admitted by Justice Hawkins, whose decisions have invariably been sustained, may be taken as foreshadowing the ultimate conclusion of the Court of Appeals.

## The Röntgen Ray Source.

By Elihu Thomson

Since writing my brief statement in which it was set out that the anode was possibly the source of the Röntgen rays within the Crookes tube, and not the cathode, I have continued my experiments and investigations and have come to the conclusion that I was mistaken largely owing to the particular structure of the tubes tested. Indeed, my later experiments have led me to this conclusion, which I think will require no amendment, namely, that the Röntgen rays are produced by the bombardment of any surface within the Crookes tube by cathode rays, or the radiant matter of Crookes; that fluorescence has nothing whatever to do with it, since substances which are bombarded and which do not fluoresce give out the rays, notably a piece of platinum. Lead glass, which fluoresces less than German glass, is still a strong source of the Röntgen rays when bombarded by the cathode rays. I have also been led to the conclusion that the more fluorescence there is produced by the bombardment the less energy will be available for Röntgen rays.

Another result of my observations has been to determine the fact that the Röntgen rays are emitted in all directions from the bombarded surface, and are not special to any particular direction. They are even emitted backward toward the cathode from which the rays which bombard the surface are sent.

In my experiments I find a very convenient way to determine the direction of the rays to be a modification of the fluorescent screen. In this tube a small patch of fluorescent material is mounted at some point between the two ends of the tube itself and backed by dark paper as usual. An opening for the eye is provided at one end of the tube and a moderate-sized opening at the far end, or the one nearest to the Crookes tube, while the whole screen tube is made of metal to prevent any lateral entrance of Röntgen rays. It will be evident that in this case when the eye and the fluorescent patch and the distant opening are in line with the source or point of emission of the rays in the Crookes tube, fluorescence will be obtained, but at no other position. Hence, when the tube is so pointed or adjusted that fluorescence is seen, it is only necessary to follow back the direction of the tube to lead to the source of the rays. By changing the direction in which observations are made, it is very easily seen that all of the directions determined will converge at some place, which is the source of the rays. In this way it was found that with a small piece of platinum in the center of the bulb upon which bombardment occurred from a concave cathode, such platinum became the source of Röntgen rays, and that it did not show the slightest trace of fluorescence.

It was also found that where the rays struck the walls of the bulb, whether they were of lead glass or of German glass, Röntgen rays were emitted in all directions from the place where the radiant matter struck, and that when such rays were projected down and along a tubular extension from the bulb containing the cathode, and opposite which tubular extension the cathode was mounted, the sides of this tubular extension became a source of Röntgen rays, sent out in many directions, even in directions which were toward the cathode terminal.

Since experimenting with the special fluorescent screen which is here mentioned, I note that experiments carried out in an entirely different manner by Messrs. Scribner and McBerty[1] have brought them to the same conclusion, and I also note that Prof. Stine[2] has, by following still other methods of investigation, found that the rays are emitted from the bombarded surface. It is interesting further to find that an improved tube, designed by one of the professors of Kings College, London, has a piece of platinum, which made the anode for convenience, and which platinum becomes, when bombarded by the cathode rays, the focalized source of Röntgen rays within the tube.[1] I may say that one of the best tubes in my possession, and one which gave the sharpest image, had a piece of platinum foil mounted in the focus of the cathode rays, which platinum foil had become sagged or bent at an angle, its structure resembling the last mentioned tube designed in London, except that it had a separate anode.

1. Western Electrician, April 4, 1896, pp. 160, 161.
2. Western Electrician, April 4, 1896, pp. 155, 159.

## The Artistic Features of Modern Electrical Experting.

By Asco Spartan

It seems to be getting fashionable for cities and villages to own and operate electric lighting plants.

The aldermanic excuse for it is "Money saved the taxpayers, streets better lighted at lesser cost, the duty to their constituents, which compels them to sacrifice personal opinions" *pro bono publico*.

The average citizen has long since become familiar with the self-sacrificing instincts of the noble Spartans, erstwhile called "city fathers," who accept office wholly for the benefits which they can dispense to their fellow beings and the personal preparation for an entrance into the "Land of Beulah."

The mystery of electricity is of course Sanscrit to the aforesaid Spartan, but where there's a job the trail is soon scented. In olden times kings were not much in the fun-making line, so they procured a jester, an all-round frolicksome devil, who was to the king a veritable wiseacre, a sycophant, a finishing touch like a nice curly tail to a pug.

The modern Spartan, being not much in the electrical line, except for what there is in it, finds it quite necessary to procure an appendage to the body politic, something to supply what Nature, notwithstanding her kindness, has overlooked. To fill this achieng void they secure an electrical expert—a genuine symposiarch, whose name is a prefix to some cabalistic combination, such as E. E. E. —I. E. E.—M. A.—D. P.—the more numerous the combinations the more valuable the service. Now there are electrical experts, men of training, of experience, men whose probity is unimpeachable; but alas! how few. Are such employed by our Spartans? Not that we know of. Instead, it is some fellow who started in to learn the blacksmith's trade, and, failing, found a job of holding ladder for a wireman and thereupon jumped his board bill and spent his first week's wages for an engraved plate and supply of cards reading "Phatrick McGhintly, Electrical Expert," or some so-called electrical salesman who has been the rounds of all the electrical companies that could be induced to try him, and finally blossoms out with his shingle, "Oldie Smart, P. A.—C. I. M. V.—M. I. M.—meaning, as is supposed, Pons Asinorum—Cæcus Itre Monstrare Vult—Maximus in Minimus.

Oldie Smart's services being secured by the band of Spartans, he proceeds to prepare specifications for the work in hand. These specifications are marvels of electrical acumen, mentioning amperes, volts, centigrades, watts (which some of the Spartans connect with Watts' hymns somehow, and it of course goes), poles to be of wood, and copper 98 per cent. conductivity.

Smart's specifications cover many pages—the smaller the plant the more pages—good sized print well spaced, never omitting a paragraph stating that a "certified check for blank dollars must accompany a bid on these specifications." Our noble Spartans count the pages, discuss the color of the cover and exclaim, Great is Allah! and with the utmost solemnity vote aye upon the motion that an appropriation be made sufficient to cover the expense of postage stamps for mailing these specifications to such electrical firms as are suggested by "our electrical expert."

In due time the specifications reach the desks of the managers of the electric companies. These managers, especially of the big companies, are all men of great business acumen, men free from guile, wholly unsophisticated, men selected for their combined innocence and sagacity. They are men totally ignorant of the wiles and wickedness of the subtle Oldie Smart, and each is impressed with the idea that the set of specifications before him was really designed by Professor Smart to fit his system. Our best salesmen (who, by the way, is always one of the mild-mannered, shrinking, timid but gentlemanly sort of men, free from all vices, and such as are found while off duty at any and all times only at the Y. M. C. A. rooms or like places of resort, is called in and Mr. Manager instructs him. His instructions are usu

1. London *Electrical Review*, March 14, 1896, p. 340.

ally to the effect that this particular job is exceptionally desirable, and the price better be cut very low. Since there are half a dozen to a dozen just such bidders doing the same thing, and Professor Smart knows it, it is extremely easy for him to work the scheme at which all bite *Plus on est de four plus on rit* Smart is ever on the alert, hunting for Spartans.

An example has quite recently come before the writer Smart, in his explorations of the wilderness of southern Michigan, discovered most miraculously and accidentally a little hamlet of native but cultivated Michiganders, situated on the banks of a beautiful stream which afforded a reliable water power some eight miles above the village. This village is only a half hour's ride by rail and drosky from the charming city of Grand Rapids, therefore accessible. Professor Smart, following up his discovery, proceeded to educate the villagers up to the delightful anticipations of electricity, and the village, like most villages in the highly civilized Peninsular state, is governed by a band of Spartans, who fell into the net set for them by the professor, and employed him to work the electrical companies in the usual manner. There being eight miles of construction work for the transmission of the electrical energy from the water power to the village, the construction of pole lines, etc., was a large proportion of the entire cost of a plant. A most elaborate and complex electrical system, in at least three different combinations, was specified, incandescent, single-phase or multiphase, arc machines and lamps, power circuits, etc., etc.

At least six electric companies prepared their bids and put up their certified checks for $1,000 each. Five companies appeared upon the scene, each with a construction man to figure construction, and at the appointed time submitted their proposals, depositing their checks with the honorable president of the council, who opened the proposals and made public their contents. All bids were in strict conformity with the specifications and varied but slightly from lowest to highest. All bidders had been especially invited by the clerk of council, and also personally by Professor Smart, to enter into competition, with the assurance of no prejudice, the lowest bidder to be awarded the contract. The bids were for about $18,000 to $20,000.

At this juncture a portion of the bidders learned for the first time that the inhabitants of the village had previously voted to bond the village for $23,000 with which to purchase the plant, build the dam, erect buildings, purchase water wheels, right of way and other items; that the dam, the buildings, wheels, etc., had absorbed over $11,000 of the appropriation, leaving only a possible $12,000 for the entire electrical plant. Professor Smart knew (if he knew anything) that the entire plant, according to his specifications, plus the cost of dam, buildings, wheels, etc., could not cost under $28,000 to $30,000. The professor was sleek, however. He had some chums to whom he had determined to award that contract. He knew there would be a considerable range in the amount of the bids, and if his chums were shut out at first (as they were) a second bid could be asked for to fit the amount of money available. This would give his friends a chance should they be the high bidders. The professor's special friend "from home" and room-mate while at the village, a construction man figuring construction for one of the electrical companies whose first bid was high, had to be taken care of. A second bid was called for, cutting out a portion of apparatus first bid on, resulting in trauspoing the highest to nearly the lowest bidder. Still the combination was not just right to fit the professor's friends and chums, and a third was asked for, resulting in an opportunity to shift the responsibility of the decision upon the noble Spartans to render an award outrageously unfair and in utter disregard of honorable methods. The successful bidder accepts the award conditioned upon the right of the council to select the arc light from one of the other bidders, which the successful bidder must furnish and install under his contract *Pis aller*

The professor's titles are evidently consistent.

The combination is satisfactory to the professor.

[illegible] gets his fee

The professor's chum gets his job

The professor's two electrical friends each get a part.

The professor continues *entre l'hommes d'importance*

## Cost of Producing Carbide of Calcium.

An announcement is made of the completion of a series of experiments conducted by Professor Houston, Dr. [illegible] for pursuit to determine the cost of [illegible] at Spray N C This commission was employed by *Progressive Age*. The plant was turned over to these gentlemen for a week by the promoters of the project, and they were given every facility for making a thorough examination of the process. So many conflicting reports have been made concerning the exact cost of producing carbide of calcium that the publication of this report, which is promised April 15th, will be awaited with considerable interest.

## Pioneer Arc Lamps with Inclosed Light.

L. B. Marks has devoted much study and experiment to the subject of enclosed arc lights, and the result of his work is embodied in the line of arc lamps, denoted by the name "Pioneer," which is now offered by the Electric Arc Light company of 687 and 689 Broadway, New York. The accompanying illustrations depict two forms of the lamp and the essential features of the inclosing bulb. Fig. 1 represents the ornamental design; Fig. 2 shows the outdoor lamp, while Fig 3 details (from left to right) the gas-check plug fitting in the mouth of the bulb, the inclosing bulb itself and the lower carbon holder which supports the bulb.

The invention of the Pioneer inclosed arc demonstrates that the efficient and economical operation of a single lamp directly across an incandescent circuit is no longer a conjecture, but a positive fact. The lamp is artistic in appearance, and is made in several designs. The mechanism is extremely simple in character, consisting merely of a pair of solenoid magnets bearing the clutch device; the tension springs, rack-work and auxiliary mechanism common to other arc lamps are entirely eliminated from the Pioneer.

Among the features which make the Pioneer arc lamp particularly valuable is the fact that the lamps require trimming at intervals of only 10 days, or two weeks, while in some situations, with short hours of burning, a monthly trimming only would be necessary. The lamp does not require cored carbons, the ordinary solid carbons being used. This results not only in a saving on the cost of carbons, but also in that of trimming—items which, together, aggregate a saving of from $15 to $20 per year per lamp.

Owing to the arc being inclosed, it is possible to run the lamp on incandescent circuits at a much higher potential than where the arc is not inclosed, so that the Pioneer lamp can be run singly, each lamp independent of the other. It follows from this also that one lamp cannot rob the other of light, as is frequently the case where two are run in series. As regards distribution of light, which is an essential factor, both in outdoor and indoor lighting, the inclosed arc has a decided advantage over the open air arc. The absence of shadows will be especially appreciated by storekeepers and factory owners, as it avoids one of the greatest inconveniences attached to the old form of arc lamp.

Not the least important advantage of the inclosed arc is its cleanliness, since all the carbon dust is completely consumed, and, above all, its efficiency as a spark arrester. This has an important bearing on the insurance question, and the lamp on this account has been thoroughly indorsed by the fire underwriters. The entire system is covered by broad patents, all of which are absolutely owned by the Electric Arc Light company.

Nearly 1,000 of these lamps will be installed in the New York store of Siegel, Cooper & Co. The contract was awarded after a competitive test with nearly every other arc lamp in the market.

## Gas Engines and Their Electrical Applications.

An interesting paper on this subject was read before the Chicago Electrical association on March 20th by Charles MacDonald. The early work in this field was reviewed, the present condition noted and the lines along which further development should be made were indicated. The writer said:

Probably the earliest record we have of the gas engine dates as far back as 1680, when Huyghens experimented with gunpowder, using it as a means for obtaining motive power. The experiments were unsuccessfully continued by Papin in 1690. Robert Street's gas engine patented 1794, indicated the direction of men's minds seeking a rival for steam before steam had been completely introduced. The Brown engine, patented in 1824, is important as being the first gas engine at work. W. L. Wright took out a patent in 1833, but it is not known if he constructed his machine. Barnett in 1838, Barsanti and Matteucci in 1857. The efforts of these men brought out many facts concerning the gas engine and the difficulties to be overcome, which led to the first practical engine, the Lenoir, in 1860. In the meantime many papers had been read on the subject of gas engines, offering some useful suggestions, which guided Mr Otto in the development of his engine, the Otto silent gas engine, whose cycle is the standard in use today and is known all over the world. Although Otto has been the most successful inventor who has yet appeared, he did not know exactly what he had and wherein consisted the merits of his machine. He attributed the economy of his engine to a slow explosion caused by an arrangement of gases in the cylinder; the compression, which is the real cause of the economy, be considered as an accidental and unessential feature.

The American Gas Engine Electric company's plant of this city is mentioned as a fine illustration of the mechanical and industrial progress of the gas engine. This plant consists of three large gas engines, of 60, 100 and 150 horse power respectively. The two first mentioned have one cylinder each, the 150 horse power has two cylinders arranged tandem, all being of the Otto cycle

Fig. 1. Ornamental Lamp.

Fig. 2. Outdoor Lamp.

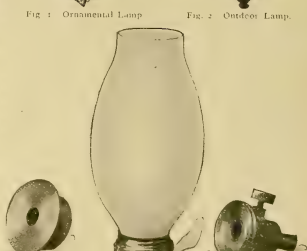


Fig. 3. Gas-Check Plug, Bulb and Lower Carbon Holder.

PIONEER ARC LAMP WITH INCLOSED LIGHT

and acting on each side of the piston, thereby giving the 60 and 100 horse power engines an impulse every revolution and the 150 horse power two impulses every revolution when working under full loads.

The engines of the future, the writer believes, should be designed so that their gases can be expanded down to atmospheric pressure. More of the heat that is lost through the walls of the cylinder and out through the exhaust port should be utilized. In governing the engine the gas and air should be reduced in the proper proportion so as always to make a combustible mixture. The engine should be designed so that its motion can be reversed. The engine should be made single and double acting. The gas producing apparatus should be developed so as to have a cheaper gas. Mr MacDonald concludes with the following prediction:

It is only a matter of time when the mechanical diffi-

culties in the gas engine will be overcome, its efficiency greatly increased, and as a piece of mechanism be as perfect as the steam engine. High smokestacks and boilers will be relegated to the background and the fire-box, converted into a motor cylinder, and citizens will no longer breathe impure air caused by smoke. The cost of production and transmission of power will be reduced to a minimum, and the lower strata of society will participate more in the luxuries of life and be raised to a higher social plane, and civilization will have taken another gigantic stride.

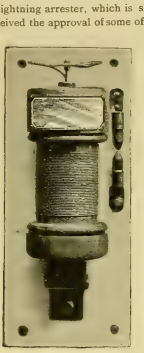
## General Electric and Westinghouse Affairs.

The news comes from New York that the agreement between the Westinghouse and General Electric companies has been signed by the representatives of these concerns.

A call was issued on April 3d for a special meeting of the stockholders of the Westinghouse Electric & Manufacturing company on June 4th to take action upon a proposed increase of capital stock from $10,000,000 to $15,000,000. The object of the increase is to wipe out the floating debt and provide capital for the increased business expected under the recent arrangement made with the General Electric company.

## Garton Lightning Arrester.

The Garton lightning arrester, which is shown in the picture, has received the approval of some of the leading



GARTON LIGHTNING ARRESTER.

electrical men of the country. The importance of protection against lightning is but too well known to all central station men, and the question is which to choose. Compared with others, these advantages are claimed for the Garton: No high ohmic resistance to break down after a few discharges; no pivots, sliding contacts or hinges to blister and stick; no fuses to replace; no inductive resistance to the discharge; no copper balls to melt. This arrester is made by the Garton-Daniels Electric company of Keokuk, Iowa, for direct or alternating current and for any current strength or voltage. It is made for use in the station, on poles or in cars.

## New Medbery Specialties.

The Fiberite company has put on the market a new line of overhead hangers, as shown by the accompanying cuts. This line, called the "Ballston," is somewhat lighter than the regular West End type, and consequently is sold at a less price. These hangers have, however, fully as much strength, and present an unusually neat appearance on the line. The bolts are five-eighths inch drop forged steel, insulated with the Medbery insulation. This insulation has stood the test of time so successfully that it is being specified on a large number of roads where superior and lasting equipment is desired. The Mason Electric Equipment company, selling agent for the Fiberite company, carries a large stock ready for delivery from Chicago.

## Vallee Shade for Incandescent Lamps.

For stations, factories, outside lights and other suitable places, the shade which is shown in the cut will be found well adapted. Painted a dark green on top and enameled white underneath, it gives a pleasing effect and throws the illumination in the desired direction. It is made of sheet metal corrugated or ribbed, and is strong as well as light. It is a durable, neat and inexpensive device, kept in stock and sold by all dealers, and manufactured by the Vallee Bros. Electric company of Philadelphia.

## Inherent Defects in Fuse Metals Experimentally Considered.[1]

By Walter E. Harrington.

I will consider in detail, and by a few tests demonstrate some of the inherent defects in fuse metals which condemn them as unsafe and unreliable in protecting electric circuits from unusual and abnormal conditions.

*First*—Fuses carry 50 to 200 per cent. current in excess of rated fusing current. A 20 ampere fuse wire in a commercial fuse block permitted the passage of 50 amperes for five minutes. Upon the fuse "blowing" an arc was maintained until broken at the switchboard by the opening of the circuit.

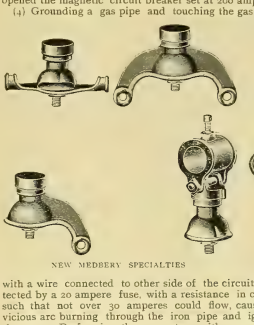
*Second*—Under short-circuits a fuse will carry excessively abnormal currents. The following tests illustrate clearly how armatures in dynamos have developed in their insulation owing to the mechanical stresses thrown upon the insulation upon the occurrence of short-circuits. The arcing attendant upon a short-circuit does more damage for the time it acts than almost any other accompanying circumstance. The importance of opening the circuit in the quickest possible time after a fault occurs is apparent

(1) Upon making a short-circuit through a five ampere fuse wire, a magnetic circuit breaker, in series with the fuse, was opened, although the circuit breaker was adjusted to open upon 250 amperes.

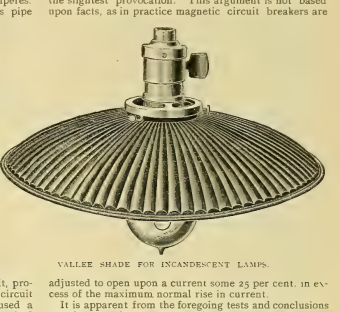
(2) Similar tests with a plug type of fuse of 10 light capacity opened the main magnetic circuit breaker set to open on 350 amperes.

(3) Similar test with a No. 30 B. & S. gauge copper wire opened the magnetic circuit breaker set at 200 amperes.

(4) Grounding a gas pipe and touching the gas pipe



NEW MEDBERY SPECIALTIES



VALLEE SHADE FOR INCANDESCENT LAMPS.

with a wire connected to other side of the circuit, protected by a 20 ampere fuse, with a resistance in circuit such that not over 30 amperes could flow, caused a vicious arc burning through the iron pipe and ignited the gas. Performing the same test with a magnetic circuit breaker in circuit set at 25 amperes opened every time with no damage to pipe.

(5) A flexible cord was chafed and the wire strands touched, causing a short-circuited condition, which is common in practice; upon closing main switch short-circuit occurred, resulting in firing or igniting the insulation and combustion of cord.

*Third*—Commercial fuse metals made of alloys so as to have a low temperature melting point will maintain a red heat. The fire risk here is quite apparent, as the temperature is such that it is liable to ignite dust or other combustible material and set a building on fire.

*Fourth*—Metals—copper, aluminum, iron, etc.—are not adapted for fuse metals, owing to the high temperatures required for fusing. Melting points of metals are as follows: Antimony, 880°; bismuth, 512°; brass (cast), 1,760°; copper, 2,000°; iron, 2,100°; lead, 620°; tin, 450°; zinc, 780°. The use of copper as a fuse metal has been unadvisably urged by some. There is, of course, one very great argument in its favor, for a given carrying capacity of copper compared to metal such as lead and tin of a lower melting temperature, the cross section is much less, and in event of the fuse "blowing" there is, of course, much less metal to be disrupted and make current-carrying gases. However, the feature of maintaining at a red temperature condemns high temperature melting points as fuse metals. Owing to such metals being maintained at times at a temperature causing oxidation and molecular changes, the life and characteristics of the metals are materially affected, thus introducing an additional uncertainty. As Captain Brophy, electrical engineer for the state commissioner of wires of Massachussetts, has repeatedly stated as his experience covering many years as an electrical inspector, that "as fuse metals age, I find that their carrying capacity increases very rapidly."

*Fifth*—Fuse metals cause arcing upon "blowing." If fuse metals would always blow under slight overload conditions, such as they are designed and naturally intend to do, the time element of arcing upon "blowing" wouldnot be much of an objection, though, of course, arcing with simple continued overload conditions does occur at times and introduces a serious fire risk, as described by Wm. McDevitt in his paper.[1] The real danger consists in the arcing following the "blowing" of a large fuse in event of a short-circuit. In power transmission and central station work, when fuses have been known to blow under short-circuited conditions, much of the damage done the fuse terminals and surrounding insulation was due to the severe, vicious arcing maintained, of course at the expense of the terminals.

*Sixth*—Enclosing a fuse is not safe, as the gases generated upon the fusion of the metal will continue to carry the current in event of a short-circuit. Arcing is a necessary evil, any effort to abolish it will be followed by disruptive electromotive forces and breaking down of insulation. Since arcing is present, let us reduce its destructive effects to a minimum. An arc is a flexible floating conductor enclosing it in anywise makes it more dense and its carrying capacity is thus materially increased. Practical test has demonstrated conclusively the importance of using as short a fuse as possible in order to reduce to a minimum the formation of gas. The longer the fuse the more metal to fuse and form gas. Further, the terminals should be so protected as to reduce to a minimum the formation of gas and arcing after the circuit is free from the first disruptive induced electromotive-forces present upon the first opening of the circuit. Let the fuse blow or vent in a fuse chamber; if you choose, prepare the chamber so that the flame cannot get out to ignite any combustible, but provide plenty of vent for the gases.

*Seventh*—Fuse metals are very sluggish in fusing. I think that this is a proposition which the previous tests demonstrate. The evil effects of this quality are obvious. It has been urged by those not familiar with the practical operation of magnetic circuit breakers that they have a "hair trigger action," and this militates against their practical utility, owing to their tendency to open at the slightest provocation. This argument is not based upon facts, as in practice magnetic circuit breakers are adjusted to open upon a current some 25 per cent. in excess of the maximum normal rise in current.

It is apparent from the foregoing tests and conclusions that fuse metals are not a satisfactory means for protecting electric circuits. The other factors of uncertainty, such as shape, position, length, temperature, alloy, Peltier effect, expansion and contraction, terminals, effect of current flow, etc., I have not gone into, as they are now pretty well understood.

If simple, slight percentage overloaded conditions are all that fuses are to guard against, then fuse metals properly made and rated are probably a better protection than no protection, but under the actual conditions in practice, for circuits of over 10 amperes capacity, it is very poor engineering practice to use fuse metals.

It might be interesting to know that electrical engineers of the highest standing, such as Dr. Cary T. Hutchinson, C. O. Mailloux, B. J. Arnold, Dr. Drysdale, T. Carpenter Smith and many others have abandoned the use of fuse metals on circuits of large capacity.

After an arraignment of such an old established device as the fuse, showing its absolute worthlessness, it is pertinent here to refer to the device which is supplanting it. I refer to the magnetic circuit breaker, which is a device that automatically opens an electric circuit through the medium of the magnetic quality of the current. Since the magnetic action of the current is simultaneous with the flow of current, the time of opening is dependent then upon the mechanical means set into operation by the magnetic action of the current flow.

The method usually employed to effect this opening is as follows: An armature of an electro-magnet moves upon the flow of predetermined current, tripping a catch permitting a spring to throw a switch out. The features in this construction alone are faulty owing to the constant time required to open the circuit, which in event of a short-circuit allows the current to assume enormous proportions. The proper construction of a magnetic circuit breaker is such that as the conditions in the circuit to be protected become more and more severe, the device shall automatically open more and more quickly. This feature of inverse time element is incorporated in the device before you, the action of which is as follows: The plunger moves up and trips a catch and continues upward and imparts its acquired energy to aid in wiping or throwing out the switch arm. Under severe overloaded conditions a point or flow of current can be reached when the velocity of the plunger with its acquired energy is greater than the compressed spring, re-

1. Abstract of paper read before the Franklin Institute, Philadelphia, March 24, 1896.

1 Western Electrician, February 22, 1896.

sulting in the opening of the switch in a manner independently of the spring. A test was made illustrating this construction. A 12 ampere inverse time element magnetic circuit breaker was taken and the spring used to aid in throwing out the switch was removed. Upon closing the circuit the plunger moved up with such a velocity that the switch was thrown out by the impact.

This feature is certainly very interesting, as it exemplifies in practice the conditions as are established by Helmholtz's law for sudden changes in the condition of a circuit

$$C=\frac{R}{E}\left(1 - e^{-\frac{Rt}{L}}\right)$$

C=Current in amperes.
E=Applied electromotive force.
R=Ohmic resistance of circuit.
e=Naperian base of logarithms.
L=Coefficient of self-induction in henrys.
t=Time of opening circuit in seconds.

This law shows mathematically that the more quickly a circuit can be opened the less the resulting flow of current will do. Further, the quicker the switch leaves its contacts, the less the arcing effect, owing to the lesser time for the current to heat up the final leaving points. The following are the salient features entering into the correct design of magnetic circuit breaker:

First—The magnetic circuit breaker must have the feature of opening the circuit in less and less time as the conditions of the circuit protected approach a short-circuit; that is, have an inverse time element. The electro-magnetic part of circuit breakers must be designed to develop more energy than is necessary to trip retaining catch. The additional energy developed must be applied directly to aid in opening the switch.

Second—No springs should be permitted in its adjustment.

Third—Insulation must not enter into the construction of the trigger or catch.

Fourth—All bearing pins and parts liable to be effected by corrosion or rust must be of phosphor-bronze and moving iron parts copper-plated.

Fifth—The armature or plunger of the magnetic circuit breaker must not act on the retaining catch or switch arm unless a free preliminary movement precedes such action.

## Electrical Exposition.

The management of the electrical exposition to be held in New York next month under the auspices of the National Electric Light association announces that applications for most of the space at the disposal of the company has already been made and assignments have been made for the greater portion. Following is a revised list of the exhibitors prepared by the management on April 3d:

Abendroth & Root company ..... New York
Adams-Bagnall Electric company ..... Cleveland
American Carbon company ..... Noblesville, Ind.
American Stoker company ..... Dayton, Ohio
American Electric Heating corporation ..... Boston
Anchor Electric company ..... Boston

Babcock & Wilcox company ..... New York
Ball & Wood company ..... New York
Birdsall Electric Manufacturing company ..... New York
Bishop Gutta Percha company ..... New York
Bossert, Wm. F. ..... New York
Bourne, Scrymser & Co. ..... New York
Bradford Belting company ..... Cincinnati, Ohio
Brady, T. H. ..... New Britain, Conn.
Bryan-Marsh Electric company ..... New York
Bryant Electric company ..... Bridgeport, Conn.
Burrowes, The E. T company ..... Portland, Me.
Burry, John ..... New York

Calculagraph company ..... New York
Card Electric Motor & Dynamo company ..... Cincinnati, Ohio
Carpenter Enamel Rheostat company ..... Hoboken, N. J.
Case, J. T., Engine company ..... New Britain, Conn.
Chapin-Douglass Electric company ..... New York
Clark Electric company ..... New York
Columbia Incandescent Lamp company ..... St. Louis
Columbia Rubber Works company ..... New York
Columbia Incandescent Lamp company ..... St. Louis
Corey, R. B. ..... New York
Crane company ..... Chicago
Crocker Wheeler Electric company ..... New York
Crouse-Tremaine Carbon company ..... Fostoria, Ohio
Cutter Electrical Manufacturing company ..... Philadelphia

Dale, Farrell & Co ..... New York
De Veau & Co ..... New York
Diehl Manufacturing company ..... Elizabethport, N. J.

Eddy Electric Manufacturing company ..... Windsor, Conn.
Edison Electric Illuminating company ..... New York
Electric Storage Battery company ..... Philadelphia, Pa.
*Electrical Engineer* ..... New York
*Electricity* Newspaper company ..... New York
Electrozone company ..... New York

Ferracute Machine company ..... Bridgeton, N. J.
Forest City Electric company ..... Cleveland
Fort Wayne Electric corporation ..... Fort Wayne, Ind.
Fuel Economizer company ..... Matteawan, N. Y.

General Electric company ..... Schenectady, N. Y.
General Incandescent Arc Lamp company ..... New York
Gordon Burnham Battery company ..... New York
[illegible] Manufacturing company ..... New York

Harrisburg Foundry & Machine company ..... Harrisburg, Pa.
Heine Safety Boiler company ..... St. Louis
Holtzer-Cabot Electric company ..... Boston
[illegible] & Manger ..... Brooklyn
Hunt, C. W. ..... New York

India Rubber & Gutta Percha Insulating company ..... Yonkers, N. Y.
Interior Conduit & Insulation company ..... New York
Iron Clad Rheostat company ..... Westfield, N. J.

Jewell Belting company ..... Hartford, Conn.
Johnston, The W. J., company ..... New York

[illegible] ..... New York
[illegible] ..... New York
[illegible] company ..... New York
[illegible] company ..... New York

[illegible] Regulator company ..... New York
[illegible] ..... New York

McCreary, A. A. ..... New York
McEwen, J. J., Manufacturing company ..... Ridgeway, Pa.
Metropolitan Telephone & Telegraph company ..... New York
Mica Insulator company ..... New York

National Carbon company ..... Cleveland
National Conduit Manufacturing company ..... New York
New York & Ohio company ..... Warren, Ohio
New York Safety Steam Power company ..... New York
Niles Tool Works company ..... Hamilton, Ohio
Nowotny Electric company ..... Cincinnati
Nuttall, R. D., company ..... Allegheny, Pa.

Okonite company ..... New York

Partrick & Carter company ..... Philadelphia
Payne, B. W., & Sons ..... Elmira, N. Y.
Peck Electrical company ..... New York
Peru Electric Manufacturing company ..... Peru, Ind.
Phœnix Iron Works ..... Meadville, Pa.
Proctor-Raymond company ..... Buffalo, N. Y.

Reisinger, Hugo ..... New York
Riker Electric Motor company ..... Brooklyn
Roebling's Sons, John A., company ..... New York
Russell & See ..... New York

Safety Insulated Wire & Cable company ..... New York
Schieren, Chas. A., & Co. ..... New York
Schiff, Jordan & Co ..... Vienna, Austria
Schoonmaker, A. V. ..... New York
Searles, A. M. ..... Chicago
Shultz Belting company ..... St. Louis, Mo.
Siemens & Halske Electric company of America ..... Chicago
Smeltzer & Co ..... Nürnberg, Bavaria
Spon & Chamberlain ..... New York
Standard Electrical Lamp & Novelty company ..... New York
Standard Paint company ..... New York
Standard Underground Cable company ..... Pittsburg, Pa.
Stanley Electric Manufacturing company ..... Pittsfield, Mass.
Stanley & Patterson ..... New York
Stirling company ..... Chicago, Ill.
Straight Line Engine company ..... Syracuse, N. Y.
Sunbeam Incandescent Lamp company ..... Chicago
Syracuse Storage Battery company ..... Syracuse, N. Y.

Tellmic Manufacturing company ..... New York
Thomson Meter company ..... Brooklyn, N. Y.
Tucker Electrical Construction company ..... New York

United Electric Improvement company ..... Philadelphia
United States Mineral Wool company ..... New York

Vacuum Oil company ..... Rochester, N. Y.
Vetter, J. C., & Co ..... New York

Wagner Electrical Manufacturing company ..... St. Louis
Walker Manufacturing company ..... Cleveland
Warren, A. K., & Co ..... New York.
Warren Electric company ..... Chicago
Watertown Engine company ..... Watertown, N. Y.
Wendell & McDuffie ..... New York
WESTERN ELECTRICIAN ..... Chicago
Weston Engine company ..... Painted Post, N. Y.
Weston Electrical Instrument company ..... Newark, N. J.
Wilkinson Manufacturing company ..... Bridgeport, Pa.
Williamsport Wooden Pipe company ..... Williamsport, Pa.
Worthington, Henry R. ..... New York

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

Superintendent Zietlow of Aberdeen, S. D, expects to have work begun setting poles for the lines to Redfield, via Warner, Mellette and Ashton in the early spring. The Standard instrument will probably be used.

Nashua, Ia., will have a telephone exchange.

The Iowa Union Telephone company will extend its lines south from Mason City, Ia., to Hampton and north to Austin, Minn., at once. Materials have arrived.

R. M. Dott, secretary of the Home Telephone company of Sioux City, Ia., reports that that company has 740 instruments in operation. A year ago there were less than 500 in use by the Iowa Union, and the Home was not in existence.

A telephone company is projected at West Bend, Ia., to build telephone lines to connect with Emmetsburg, Rodman, Cylinder, Whittemore, Hobart, Algona, Ottosen, Bode, Livermore, Arnold, Humboldt, Bradgate and Rolfe. The capital stock is $25,000.

The Henderson County Telephone company of Stronghurst, Ill., has let the contract for setting the poles, ready for stringing wires, from Stronghurst to Biggsville and Gladstone.

An automatic telephone exchange is proposed for Redwood Falls, Minn., and the projectors hope to eventually connect with the Northwestern Telephone Exchange company.

The Portage Telephone company, which was recently granted a telephone franchise at Portage, Wis., has elected the following named officers: H. W. Little, president; E. H. Warner, vice president; Frank Bell, secretary and manager.

The La Crosse & Southeastern Telephone company has been incorporated at La Crosse, Wis., to build a line to Viroqua.

## Compensation of Consulting Engineers.

There is a movement on foot among the consulting electrical engineers of Chicago to form an organization for the purpose of establishing a uniform schedule of fees and for the mutual enforcement of a stringent code of professional ethics, after the manner of the societies of architects. A meeting for this purpose was held on April 4th at the office of W. D. Ball & Co., which was attended, in person or by representatives, by W. D. Ball & Co., Forée Bain, B. J. Arnold, Frank B. Rae, L. L. Summers, Pierce & Richardson and Charles G. Armstrong. The discussion was informal, and Messrs. Ball, Arnold and Armstrong were appointed a committee on permanent organization. It was the unanimous opinion that the independent consulting engineers—those giving professional services exclusively to clients and in no way interested in the construction work or selling agencies—should mutually agree to do their work on a strictly professional plane and not compete on a commercial and financial basis. It was urged that a uniform rate—probably five per cent. for entire charge and supervision of plants—should be charged by all, and that selection should be made on reputation and fitness for the work in hand rather than as the result of a scramble to get in the lowest bid. The idea of maintaining a strict rate of professional charges and of confining the organization to consulting engineers exclusively met with general favor, and there seems little doubt that an association of strictly professional men something heretofore unknown in the electrical industry of the United States—will be the result of this sentiment.

## Notice of Western Railroad Arrangements.

As has been officially announced, the annual convention of the National Electric Light association will be held in New York city, beginning May 5th next.

Under the auspices of the association will be held a great electrical exhibition, of which due announcement has also been made. Elaborate inaugural ceremonies, including the formal opening of the exhibition by Gov. Morton, will occur on May 4th, and the railroad arrangements outlined below have been made with special reference to this interesting event.

The concurrence of these two events promises to make an occasion of unusual interest and importance, and a very large attendance is expected. In view of this, and for the greater convenience of members and their friends, arrangements have been made for a special train to leave Chicago Saturday, May 2d, at 5 P. M. This train will be of the latest and most approved equipment and will make the run to New York in 24 hours, the route being the Lake Shore & Michigan Southern and the New York Central and Hudson River railroads. Delegates may join this train en route. The rate for the round trip will be one and one-third fares on the certificate plan. Any desiring to do so may stop off at Niagara Falls either going or returning.

Mr. C. O. Baker, Jr., master of transportation for the association, has promised to come to Chicago May 2d, and give the train his personal supervision through to New York.

To aid us in determining as early and definitely as possible the amount of accommodations to be provided it is urged that prompt application for reservations be made. Such requests, as also for detailed information, may be addressed to C. K. Wilber, western passenger agent Lake Shore & Michigan Southern railway, 180 Clark street, Chicago, or to the undersigned.

C. H. Wilmerding, President National Electric Light association, 139 Adams street, Chicago.

W. A. Kreidler, of Transportation committee, 510 Marquette building, Chicago.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, April 4.—There is a possibility of a great strike on all the street railroad lines of this city operated by the Metropolitan Street Railway company. The men say that no reason was given for the discharge of nine Lexington avenue gripmen and one Broadway conductor, and that the real cause was their connection with the Amalgamated Association of Street Railway Employés of America. The officers of the company declare that the men were dismissed for entering saloons while on duty, thus violating the rules. There is a question of veracity between the employes and employers. A committee of five employes called on President H. H. Vreeland of the Metropolitan company yesterday and asked him to take back the men. He refused. A truce was declared pending the arrival of William D. Mahon, president of the Amalgamated association, who is expected to reach New York to-morrow and will at once confer with his coadjutors here. No strike can be ordered in his absence. It is understood that upon his arrival another formal demand will be made for the re-employment of the 10 men. Should it be again refused, as it probably will be, the employes will ask the company to submit the question to arbitration. Should this proposition be declined, a strike may be ordered. More than 5,000 men will be called out in that event.

Chief Engineer Martin, of the Brooklyn bridge, states that the General Electric company and the bridge officials have reached an agreement with reference to equipping 20 bridge cars with motors in order to supplant the steam engines at the terminals and also enable the hauling of trains across the span when the

cables are not in use. The General Electric company will equip 20 new cars with four motors of $62\frac{1}{2}$ horse power each, giving each car 250 horse power. The cars with which the experiments were conducted for 30 days had 200 horse power, and were not considered powerful enough. The company is to receive $72,900 for its work. The motors will probably be ready before the cars are completed. Mr. Martin does not expect to see the cars delivered before August 1st. Each bridge train will have one of these cars in it, and in case of any accident to the cable the electricity could be used without loss of time. At the ends of the bridge the newly equipped cars will be used to do the train switching. W. F. O.

## PERSONAL.

W T M Mottram died suddenly in San Antonio, Texas, on March 7th.

The nearest living relative of Professor Röntgen is said to be his first cousin, the Rev. Dr. J. H. C. Röntgen, pastor of the First Reformed Church of Cleveland.

J. J. Gates, formerly manager of the Perkins Electric Switch Manufacturing company of Hartford, died of typhoid fever on April 2d and was buried on Saturday of last week. Mr. Gates was widely known, and his friends throughout the West will be greatly shocked to learn of his death, as it was not generally known that he was seriously ill.

Charles G. Armstrong of Chicago has been appointed electrical engineer for the state of Wisconsin for all buildings in charge of the State Board of Control. The governor of Wisconsin has also appointed Mr. Armstrong electrician to have charge of the remodeling of the mechanical and electrical equipment of the state capitol at Madison.

The announcement of the death of W. Boardman Tobey of Pittsfield, Mass., in South America about two weeks ago, will come as a great shock to many electrical friends in the West as well as in the East. Mr. Tobey left Pittsfield a few weeks ago to take charge of an electric plant in Guayaquil, Ecquador. A dispatch was received on the morning of March 28th stating that he was very ill, and at one o'clock in the afternoon a second dispatch brought the news of his death. Mr. Tobey was about 27 years of age. He was born in Great Barrington, Mass., and after passing through the public schools went to Cornell University, from which institution he graduated. A short time afterward he became associated with the Stanley Electric Manufacturing company of Pittsfield, and he was also connected with Mr. Stanley in the laboratory company. He retained his connection with the Stanley interests until last fall, when he resigned and connected himself with the Ecquador company. He was married March 6, 1895, and the widow survives him, together with his father, mother and two brothers. Mr. Tobey was a well-informed electrical student, and possessed many engaging personal traits. He installed the Stanley two-phase apparatus on exhibition at the World's Fair, and made many friends during his stay in Chicago.

It is now pretty generally known that E. M. Scribner, who has for over a year been manager of the supply department of the Western Electric company, Chicago, recently resigned that position to accept the management of the sales department of the Byrant Electric company of Bridgeport, Conn. But there will be not a few of his many friends who will learn with pleasure of the handsome manner in which he was entertained before his departure to his new home in Bridgeport by a coterie of his numerous Chicago friends and business associates. Thursday evening, April 2d, a private dining-room at the Great Northern hotel was the scene of a gathering of as pleasant a party of electrical men as has assembled for years. The occasion was the dinner given in honor of Mr. Scribner and as a farewell by Western Manager A. D. Chandler of the American Circular Loom company. The dinner began at 7:30 and ended at 12:30. Those present besides Messrs. Scribner and Chandler were: Messrs. Crandall and Wilkinson of the Western Electric company; Morse, Kerite company; Wolff, New York Insulated Wire company; Brown, Central Electric company; John P. Barrett, city electrician, and Brooks, American Circular Loom company. It was a matter of regret that Charles Holmes of the Chicago Edison company was unable to attend, and also J. Franklin, Jr., of the Commercial Electrical Supply company of St. Louis, who telegraphed at the last moment that he was detained at home on account of illness. Without attempting to give in detail the menu, which was headed with the familiar expression, "Farewell to 'dear old Scrib,'" it may be said that it consisted of almost every delicacy in and out of season. It was a very pleasant party and thoroughly enjoyed.

## TRADE NEWS.

The Westinghouse Machine company's orders for March include three vertical cross-compound engines, each 1,600 horse power, for the Allegheny County Light company's station, Pittsburg, Pa.

Arrangements have been made by which Ahearn & Soper, Ottawa, Canada, will have the exclusive sale of the Westinghouse Electric & Manufacturing company's apparatus in the Dominion of Canada.

The Washington Electric company of 31-45 West Randolph street, Chicago, makes an excellent line of electric light appliances for stage use, including rheostats, dimmers, focusing lamps and controlling stands. Al eaflet giving detailed information is sent upon application

A very attractive souvenir is being distributed by the Kaufman Telephone Construction company, 353 Dearborn street, Chicago It is entitled "America's Wonder," and comprises a sketch of the city of Chicago and some of its most prominent enterprises. The work is handsomely illustrated with views of public buildings, hotels, commercial houses and philanthropic institutions It is well printed and altogether a most pleasing publication

The Arnold electric power station system, recently described in this journal, is meeting with immediate success It has been adopted for the new 300 horse power plant of the Chicago Board of Trade and also for the 1,000 horse power station of the Suburban Railroad company of Chicago at Riverside. Other large orders are promised. B. J. Arnold of 1541 Marquette building, Chicago, is the inventor and managing director of this promising system.

The Cutter Electrical & Manufacturing company, 1112 Sansom street, Philadelphia, announces that it has in hand a beautiful illustrated catalogue of C-S flush switches and accessories. This promises to be the most elaborate catalogue devoted to this subject, and will be sent post-paid to all interested. The company is also preparing an illustrated catalogue of the I-T-E circuit breaker, about which much favorable comment is heard. This will be ready early in May.

"In no department of engineering has it been so fully or so frequently demonstrated that good work and good material pay as in the field of electrical applications of power. Cheap devices, like cheap labor, mean a constantly increasing repair account. The reduction of this often unnecessarily large item of expense means dividends to the operating company." Thus writes Fred M. Locke of Victor, N. Y., in prefacing the latest catalogue of his line material specialties of high insulation, and then he proceeds to describe some good material. The book is worth sending for.

A very unusual offer, by which electrical supplies may be obtained at a reduction of from one-quarter to one-half of the wholesale cost, is made by the Jones Bros. Electric company, 120-126 East Court street, Cincinnati, O. This company is closing out its supply department, with the view of confining its energies more closely to light and power station work, and it takes this method of accomplishing its object speedily. The inventory is now ready and will be mailed on application. This sale undoubtedly affords an opportunity to obtain electrical supplies at exceptionally low prices.

Owing to increasing business, the Crown Woven Wire Brush company of Salem, Mass., has moved into the new Powers block, where it has a model factory and hopes to turn out even better goods than heretofore. The growth of this company's business is remarkable and is one of the results of making honest goods. The Crown "K" brush especially is meeting with great success. The company is not only selling its goods all over the United States, but is sending them to Mexico and Canada, and hopes very soon to place them on the European market. The new factory will enable them not only to turn out brushes in greater quantities, but to compete with any goods in the world in quality and price.

The annual meeting of the Phœnix Interior Telephone company was held March 25th, and the reports showed a successful year of business, with bright prospects for the future. In order to meet the growth of the business, arrangements are being perfected for larger quarters. The Phœnix telephone is said to be second to none manufactured, and great care is taken that each instrument is thoroughly tested before it leaves the factory. The following named directors were elected: Heinrich Meyer, James L. Sharp, John H. Scofield, George W. Sutton, Arthur E. Walradt, Wright C. Stout and L. Lambelet. Later, at a meeting of the directors, the following named officers were elected, after a handsome dividend had been declared: President, George W. Sutton; vice-president, James L. Sharp; secretary and treasurer, John H. Scofield.

## BUSINESS.

Geo. S. Searing, the Chicago representative of the Hart & Hegeman Manufacturing company, has removed his office from 1644 to 1440 Monadnock block.

Tuerk's electric ceiling fans for both direct and alternating current are described in a tasteful little pamphlet issued by the Tuerk Water Meter company of Fulton, N. Y.

The engine made by the American Engine company of Bound Brook, N. J., of which F. H. Ball is now vice-president and general manager, will be known as the American Ball engine.

A representative of the WESTERN ELECTRICIAN recently met C. O. Baker, western manager of the Anchor Electric company, Boston, while on a trip throughout the Northwest. Mr. Baker was feeling much encouraged over the outlook for his company in the West, and orders already taken indicate that the Anchor specialties are well appreciated. Mr. Baker has opened an office for his company at 1654-5-6 Monadnock building, Chicago.

The reliable Partrick & Carter company of Philadelphia, in its '96 catalogue, pays especial attention to annunciators. This company claims to make the best annunciator in the world, and certainly its sales go far to support the claim. It also deals in house goods and general electrical supplies, and its catalogue should be in the hands of every electrical buyer. As a special feature, the company asks all persons desiring experimental work to give it a trial, as the best material and workmanship, with low prices, are guaranteed. Any instrument or apparatus desired can be made from drawings or written description

The Electric Appliance company has closed arrangements for the agency for the Dayton electric ceiling fan and has a complete line of these fans in operation at its salesrooms at 242 Madison street, Chicago The Dayton company makes an attractive line of these goods, including a handsome electrolier and column fan Some of the special points claimed for the Dayton fans, aside from their artistic finish, are that they have four blades, run at a high speed, and have a very high efficiency

The first catalogue of the Warren Electric & Specialty company, manufacturer of incandescent lamps at Warren, O., is very creditable. All kinds of lamps are made, and the company makes a point to fill orders with exactly the voltage and efficiency desired. A meritorious special form of lamp is that known as the desk lamp. This has a broad surface at the bottom, where the glass is clear, but the sides are green or frosted. This lamp is designed to throw the light upon the work, and at the same time protect the eyes from the direct light. It is especially recommended for the use of bookkeepers, copyists, etc.

The Interior Conduit & Insulation company of 527 West Thirty-fourth street, New York, has placed its ventilating department in charge of W. H. A. Davidson, formerly of the Davidson Ventilating Fan company. The company does not manufacture fans, but adapts Lundell motors thereto by direct connection with all the different styles of exhaust fans. Its direct-connected exhaust fan equipments have been adopted by the United States government, and are being installed at the present time in the Corcoran art gallery and the new Congressional Library at Washington, D. C. These outfits are also specified for the state capitol at Olympia, Washington; by the New York Board of Education, and by many of the leading architects and engineers throughout the country.

The National Underground Cable company has just been awarded a contract by the Toledo Traction company, Toledo, Ohio, for all the underground cables to be used by the latter company during the year 1896. This contract for underground cables is one of the largest ever given out in the United States, and covers cables for several kinds of service, including railway feeder, electric light and power distribution. When finished Toledo will have the only plant in the world in which series arc circuits and the three-wire system will be distributed from the same station. The distribution will be done from one immense central station, and the sizes of cables to be used run from No. 6 B. & S. to over 1,000,000 circular mils. As a result of its continuously increasing business, the National company's cable factories at Harrison, N. J., and conduit factories at Hasting-on-Hudson, N. Y., are compelled to run night and day to keep up with orders.

The Partridge Carbon company of Sandusky, O., has received from the South Jersey Street Railway company of Point Pleasant, N. J., two carbon brushes which had been supplied by the Partridge company some time ago to the railway company. These brushes had run, it was estimated, in the neighborhood of 50,000 miles. In a letter accompanying the brushes an officer of the railway company says: "These two brushes have been in use seven months, during which time the car, from motors of which brushes were taken, has made a mileage of about 45,000 to 50,000. The brushes sent are about the worst worn of a set of 10 that I have in my possession. To me this is something extraordinary, as I have had the experience of seeing new carbon brushes put on motors every other night. We are using Westinghouse No. 12 20 horse power motors. I would say that I originally bought 100 brushes, and I have them all now, none having been used except the 10 as above, which are good for another 50,000 miles run. I do not think there is another such brush on earth as the Partridge for long life, wear on commutator, etc. Our line runs along the beach front, where sand and dust are in plenty."

A representative of the WESTERN ELECTRICIAN recently visited the up-town establishment of Julius Andrae & Sons company, 225 West Water street, Milwaukee, Wis., and found business wonderfully brisk. The Andrae bicycle is thoroughly "on the boom," and Mr. Andrae reports a steady increase in the electrical department. This concern has just installed a complete Andrae telephone equipment in the Northwestern Wire Mattress company's factory at Kenosha, Wis. The installation consists of 21 instruments in all; 12 telephone outfits have also been put into the bicycle factory of the Sieg & Walpole Manufacturing company's establishment at Kenosha. In addition to this the Andraes are at present placing a similar outfit in Guernsey's Refrigerator company's factory at Fond du Lac, Wis. Those purchasing telephones would find the concern's voluminous compilation of testimonials of interest. These letters abound with expressions of praise for "the most perfect long or short-distance telephone manufactured." Taken all in all, the Julius Andrae & Sons company has reason to feel proud of its thriving business

Those who are contemplating the installation of steam and electrical apparatus should send for the handsome catalogue issued by the J. H. McEwen Manufacturing company, between Dey and Cortlandt streets, New York city. This company reports having recently closed contracts with the following named customers: Hingham, Mass., Electric Railroad company; Morris Coal company, Jobs, Ohio; Carbondale Fuel company, Des Moines, Iowa; Miner-Hillard Milling company, Miner's Mills, Pa.; O'Neill & Patterson, Bunola, Pa.; Ellsworth & Morris, Sutterville, Pa.; W. J. Smith, Mount Pleas-

ant mines, Scranton, Pa.; New York & Pennsylvania company, Johnsonburg, Pa.; Frankford & Tacony Street Railroad company, Tacony, Pa.; Charles S. Solomon & Co., St. James Hotel, Washington, D. C.; Dr. J. S. Gilbert, Bordentown, N. J.; Kunkle Bros., Pittsburg, Pa.; American Glue company, Springdale, Pa.; Chicago Hardware Manufacturing company, Chicago, Ill.; Lea & Carroll, Pittsburg, Pa.; H. W. Johns company, New York; Link-Belt Machinery company, Chicago, Ill.; Westinghouse Light, Heat & Power company, York, Pa.; German-American Brewing company, Buffalo, N. Y.; Monongahela House, Pittsburg, Pa.; Armour company, Chicago, Ill.; V. Henry Rothschild & Co., Trenton, N. J.; Jeffrey Manufacturing company, Columbus, Ohio.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

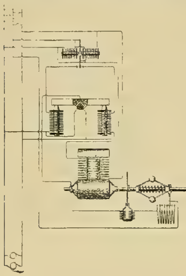
*Issued March 31, 1896.*

557,099. Multiple Series System of Electrical Distribution. Francis B. Badt, Chicago, Ill. Application filed September 25, 1895.

The method of regulating a multiple series system of distribution consists in passing an electric current through the translating devices in multiple series, diverting a portion of the current from the overloaded side, passing the diverted current through an electric motor, opposing to the rotation of the motor a force independent of the current supply and varying in accordance with the strength of the current flowing through the motor, and shifting the motor from one side of the system to the other to maintain the same in circuit with the underloaded side.

557,114. Trolley Pole Support. Nathan H. Davis, Philadelphia, Pa. Application filed November 8, 1895.

A base plate is adapted to be secured to a car, and there are a plate having an annular flange, a bracket adapted to fit over the flange, having a cylindrical flange adapted to fit over the plate, an annular plate adapted to fit under the flange and to be secured to the flange, and mechanism for supporting the trolley pole secured on the bracket.



NO. 557,099.

557,121. Magnetic Core Separator. Oriel M. Graves, North Yakima, Wash. Application filed June 17, 1895.

In a magnetic ore separator the combination is claimed with a frame and ore conveyor, of a drum and roller, an endless needle-carrier passing around the drum and roller, magnetic needles upon the needle-carrier, a spring-actuated pivoted hammer-plate in operative proximity to the edge of the needle-carrier, and co-operating projections upon the drum and hammer-plate designed to actuate the latter in opposition to the spring.

557,139. Rail Bond and Electrical Connector. Chas. E. Moore, Chicago, Ill. Application filed October 9, 1895.

A rail bond is described, consisting of a conductor provided with a flange at each end, and a reduced portion projecting beyond the flange, and a sleeve to surround the reduced portion, and means associated with sleeve and conductor, so that the two parts are forced toward each other and thus expanded within the aperture of the rail.

557,153. Apparatus for Telephone Lines. Charles E. Scribner, Chicago, Ill. Application filed August 17, 1895.

One claim is for the combination with a telephone line circuit, having a partly metallic and partly grounded return circuit, of a repeating coil having four helices, two of the helices being included serially in a continuous conductor of the circuit, and the other two helices being included serially in a ground branch from the extremity of the metallic return circuit, a condenser in a bridge uniting the points of junction of the serially connected helices, a responsive device and a source of current in a ground branch from the continuous line conductor at a central station, and means for closing a ground branch to the same conductor at the sub-station.

557,154. Apparatus for Telephone Lines. Charles E. Scribner, Chicago, Ill. Application filed August 17, 1895.

A local storage battery is located at a sub-station, a central source of charging current is connected therewith, and there are also provided a switch at the central station controlling the connection of the source of current with the local storage battery, and means for controlling the switch from the sub-station.

557,16[illegible]. Electric Meter. Charles P. Steinmetz, Schenectady, N. Y. Application filed January 15, 1896.

The meter has one element supplied with the energy voltage and the other element with the current flowing in the system.

557,155. Regulating Electric Motors. James Burke, Newark, N. J. Application filed September 4, 1895.

[illegible] operated from a constant potential circuit, another [illegible] electric machine coupled mechanically to the motor, the armatures of the two machines being in series and a [illegible] and [illegible] for varying and reversing the field of the additional dynamo.

557,218. Commutator for High Voltage Dynamos. August J. Oehring and Henry H. Wait, Chicago, Ill. Application filed August 20, 1895.

Segments are secured to the face of a disk of wood by screws passing through the segments and into the disk, but not passing completely through the disk, thus eliminating metallic portions upon the rear of the disk electrically connected with the circuit of the machine.

557,224. Electric Switch. Charles G. Perkins, Hartford, Conn. Application filed January 2, 1894.

The claim: In an electric switch, in combination, an insulating base provided with a central threaded nut and bearing duplicate pairs of conducting poles, a spindle with a handle at one end and a screw-thread at the other end, which thread fits and turns in the threaded nut in the base, an insulating commutator block bearing conducting poles, and having a smooth-walled central perforation through which the spindle passes, a sleeve supported by and connected so as to rotate with the spindle, said sleeve having a positive connection with the commutator block for rotating the same, and a pair of spring plates engaging the sleeve.

557,229. Electric Arc Lamp. William D. Ray, Chicago, Ill. Application filed July 11, 1894.

The inventor claims the combination with a curved tapering core, mounted to rotate about an axis, of an electro-magnet threaded by the core, carbon carriers supporting curved carbons, and mounted to rotate about an axis, and a frictional device for increasing or decreasing the friction tending to retard the descent of the carbons to compensate for the variations of the pull exerted thereby.

557,257. Electric Cut-out. Robert G. Davis, Brooklyn, N. Y., and Albert M. Torrance, Bennington, Vt. Application filed July 5, 1893.

Two terminals adapted to be connected to a circuit, a contact post intermediate the two terminals, a fusible conductor connecting one terminal with the contact post, an arm pivoted intermediate its ends, connected with the other terminal and adapted to be thrown into or out of engagement with the contact post at pleasure, a spring secured at one end, and having its free end in contact with the shorter portion of the pivoted arm, and arranged to have a tendency in its normal position to hold the pivoted arm in contact with the contact post, and when the pivoted arm is revolved away from the contact post and beyond the point of greatest depression of the spring to hold the pivoted arm in its open position.

557,258. Electric Railway. Patrick B. Delany, South Orange, N. J. Application filed October 10, 1892.

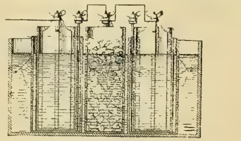
The last claim is for an insulator for an electric conductor, having embedded therein an electric heating coil.

557,282. Electric Car Heater. Joseph G. Noyes, Milford, Conn. Application filed August 16, 1895.

The claim: An electric heater having a corrugated heater-body containing electrical conductors embedded in cement in the corrugations on one face thereof, and being provided with perforations between the corrugations which contain the electrical conductors.

557,284. Telephone Switch and Support. Edward C. Paramore, Philadelphia, Pa. Application filed April 24, 1895.

In a combined receiver support and cut-out for telephone instruments, and in combination with the contact points of the bell and battery circuits of the instrument, a stationary support is claimed which is bifurcated to receive the instrument, a movable support eccentrically pivoted to the stationary support, adapted to be thrown in one direction by the insertion of the receiver, and in the other direction by its withdrawal, a rearwardly projecting arm carried by the movable support, contacts carried by the arm adapted to close and open the battery circuits of the instrument when the receiver is placed in the supports, and to open the bell circuit and close the battery circuit when the receiver is withdrawn from them.



NO. 537,356.

557,324. Art of Electric Dyeing. George D. Burton, Boston, Mass. Application filed September 25, 1894.

The invention consists in intermingling a dyeable fibrous substance with a dye liquor, and passing an electric current of forty or more volts through that part of the dye liquor with which the fibrous substance is intermingled, whereby the fibers thereof are forced apart and thoroughly exposed to the action of the dye liquor.

557,325. Art of and Apparatus for Electro-dyeing. George D. Burton, Boston, Mass. Application filed October 31, 1894.

In this process a dyeable object is subjected simultaneously to the action of a dye liquor, and an electric current of forty or more volts passed through the liquor, the current exposing the fibers of the dyeable object to the action of the dye liquor, and the liquor being free from dissolving metal during the dyeing operation.

557,326. Art of and Apparatus for Electric Dyeing and Shrinking. George D. Burton, Boston, Mass. Application filed February 25, 1895.

The features of this invention include a dye vat, a dye liquor therein, two electrodes disposed in contact with the liquor and connected with opposite electric poles, the positive electrode being composed of carbon and the negative of lead.

557,342. Shade for Incandescent Electric Lamps. Solon O. Richardson, Jr., Toledo, Ohio. Application filed November 1, 1892.

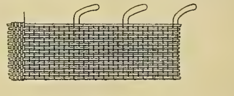
A shade for incandescent electric lamps, comprising a bulb formed of alternate series of horizontal thick and thin portions, the outer and inner surfaces of the thick portions being parallel, and the thin portions connecting the thick portions with the outer and inner surfaces thereof, curved inwardly and outwardly respectively.

557,355. Galvanic Battery. Edward S. Boynton, Brooklyn, N. Y. Application filed February 21, 1895.

A galvanic battery comprising two or more elements grouped in one receptacle and having an electrolyte common to all, each element consisting of pairs of electrodes arranged one within the other, the outer electrode of each pair being held and supported in immediate juxtaposition with adjacent corresponding electrodes by means of a strengthening insulating medium or bond that extends downwardly to the full length of the electrodes.

557,356. Galvanic Battery. Edward S. Boynton, Brooklyn, N. Y. Application filed September 31, 1895.

The battery has an outer-containing receptacle, a series of elements, containing each a positive and negative electrode arranged in groups in operative relation to a common electrolyte in the receptacle, the outer containing jars of each element being provided with a series of vertically arranged holes or passages to afford eduction and induction ports at different levels for a circulation of the common electrolyte.



NO. 557,386.

557,384. Fan Motor. Robert H. Hassler, Dayton, Ohio. Application filed November 27, 1895.

This is an electric motor with field and armature revolving in opposite directions in a vertical plane, a wheel attached to the armature and a second wheel attached to the field, the two wheels adapted to drive by friction a third wheel revolving in a horizontal plane and attached to a ventilating fan.

557,386. Rheostat. Harry E. Heath, Windsor, Conn. Application filed December 26, 1895.

The inventor claims the combination in a rheostat of a supporting device and parallel flexible and non-conducting wireholders, and wires interwoven alternately above and below such holders for sustaining such wire electric conductor, and an enamel or covering material upon the surface of the wires and wireholders, the material fastening the wires and holders to the supporting device.

557,398. Distribution of Electric Currents. Isidor Kitsee, Philadelphia, Pa. Application filed September 16, 1895.

The method of distributing electrical energy consists in providing the translating or consuming circuit of a converting device with resistances placed in a shunt circuit to a resistance opposing the flow of the current in the primary of the converting device and automatically short-circuiting or cutting out the same through the active employment of the consuming devices placed in the circuit.

557,403. Electric Flash-light Apparatus. George R. Lawrence, Chicago, Ill. Application filed May 17, 1895.

An electrically connected supporting frame or standard is described, in combination with an electrically connected piece secured parallel with the standard, a series of arms or pans movably and adjustably secured to the standard, each carrying an electric conductor, and a number of fuses adapted to complete the circuit on the pans or arms and to ignite the powder.

557,422. Means for Transmitting Electrical Energy. Thomas W. Onderdonk, New York, N. Y. Application filed April 9, 1895.

The combination is claimed with an electric circuit having an intermitting device therein, of a dental tool-holder comprising an electro-magnet in the electric circuit, a tool-holder mounted to reciprocate on the electro-magnet, an armature having pivotal connection with the electro-magnet and serving as a hammer to drive the tool-holder in one direction, and a spring for returning the armature.

557,442. Trolley for Electric Railways. Henry A. Seymour, Washington, D. C. Application filed February 1, 1896.

The first claim follows: The combination with a trolley pole, and means for raising the trolley into contact with an overhead conductor, of an electro-magnet adapted to exert sufficient pressure on the trolley pole to maintain the trolley in good contact with the conductor when the car is running.

557,497. Electric Gate Operating Mechanism. Francis J. Dyett, Ilion, N. Y. Application filed November 1, 1893.

The arrangement includes the combination with a gate shaft and a motor, of the driving shaft having the reversing gears connected with the motor shaft, a clutch operating to alternately make one or the other of the gears fast with the driving shaft, and a switch lever in circuit with the motor and connected with the clutch.

Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, APRIL 18, 1896. No. 16

## Niagara Model for the Electrical Exposition.

By Orrin E. Dunlap.

One of the attractions to be seen at the forthcoming electrical exposition to be held in New York city will be a beautiful model of Niagara in miniature. This model is a remarkably pretty piece of work and has been displayed in the map room of the Cataract House at Niagara Falls, where it was operated by water power, but while on exhibition in New York it is intended to operate it, if possible, by electricity from Niagara Falls, a distance of nearly 500 miles (the New York Central Railroad company estimates the distance by rail at 462 miles). To accomplish this feat it is proposed to utilize either a telegraph or telephone wire. The electric power is to be taken from the big 5,000 horse power generators in the central station of the Niagara Falls Power company, and if the effort proves a success, it will be most significant of the possibilities of heavier cables which it would seem must be erected at a later day to carry larger quantities of Niagara's energy across the Empire State.

In connection with this article two pictures of the model are given, both taken just before it was boxed for shipment to New York. The illustration on this page, Fig. 1, is a half-tone reproduction of the model, giving a bird's-eye view of the upper Niagara river, the city of Niagara Falls, the Niagara gorge and a glimpse of Canada. The model shows the city of Niagara Falls and surrounding locality from a point just beyond the line of the power tunnel on the north to the center of Goat Island on the south, and from a point beyond the Clifton House, Canada side, on the west to a point beyond the big tunnel canal on the east. The model is 12 feet long by three feet six inches wide. The height of the model when on exhibition is about six feet, but one-half of this is a fine glass case which protects it from meddlesome hands and dust. The scale upon which the model was made is about 100 feet to every inch and a half. A comparison of this fact with the dimensions mentioned will give one a fair idea of the model. The streets and buildings of the city are in perfect form and it is like standing high above the city to enjoy a look at the pretty work The eyes do not tire, but as they search about and pick out the various buildings the pleasure is a novel one. In all 197 buildings are shown, and the number of trees which beautify the streets of the city in the model is 1,150.

While on exhibition it will stand so that the points of the compass will be retained with accuracy. It will be seen by the picture that at the east end of the model a little wooden case rises above the main surface of the model and, standing in front of it, the visitor learns by a statement on a metal plate that he is looking at a model of the Niagara Power company's plant at Niagara Falls, N. Y., and such it is. The power houses, wheel-pits, cross-sections of the canal, turbine wheels and the tunnel are all before him. In this is found the actuating thought that led to the construction of this truly wonderful piece of work. Day after day many visitors at the Falls make eager inquiries as to the workings of the tunnel and its object. Some find this a difficult matter to explain, but here it is all clearly presented. In this model is shown what can be seen in no other way, for it would be utterly impossible to take all the visitors down into the deep wheel-pit to show them the working of the turbines. A lettered plate tells the visitor to drop a nickel into the slot and pull the ring way out. When this is done water will flow down the penstocks upon the turbines, which will set in motion the turbine shaft to the dynamo that will generate the power. Above is shown the dynamos, with a small flight of stairs leading to the top of them. This appears more clearly in Fig. 2, which is an end view of the front of the model and gives one a glimpse of the Niagara Falls Power company's plant in miniature. There is a sectional view of all this showing the turbines, the penstocks and shafts. The first glance at this part of the model is quite deceiving. The visitor gains the idea that he sees four turbines on each side, but the fact is there are two on each side and the others are reflected by a mirror neatly concealed in the back. As the water passes from the turbines it enters a drift or small tunnel leading to the main tunnel and is carried through it to the gorge below. Standing on the north side of the model, a sectional view of the entire length of the tunnel and the water passing through it is obtained. Air bubbles are pumped into the water so as to make it more perceptible to the sight. From the west side of the portal of the tunnel, the gorge, the American Fall and a portion of the lower river is obtained. The steamer Maid of the Mist is near the American dock. The arrangement of the American Fall and the little fall between Luna Island and Goat Island is most perfect. The accurate effect is created by a porcelain plate tinted and burnt in. If a nickel is dropped in the slot on the north side, six electric lights located in various parts of the city and three lights in the Cataract House shine forth and add to the scene. While at the Falls they were operated by a storage battery concealed beneath, but in New York Niagara power may be called into service. One thing that all will be impressed with is the beauty of the river as it is represented. The upper river is shown from the Falls to a point above where the tunnel canal taps the river. All the islands and bridges are shown. The river bed on the part above the rapids is of glass. Midway down

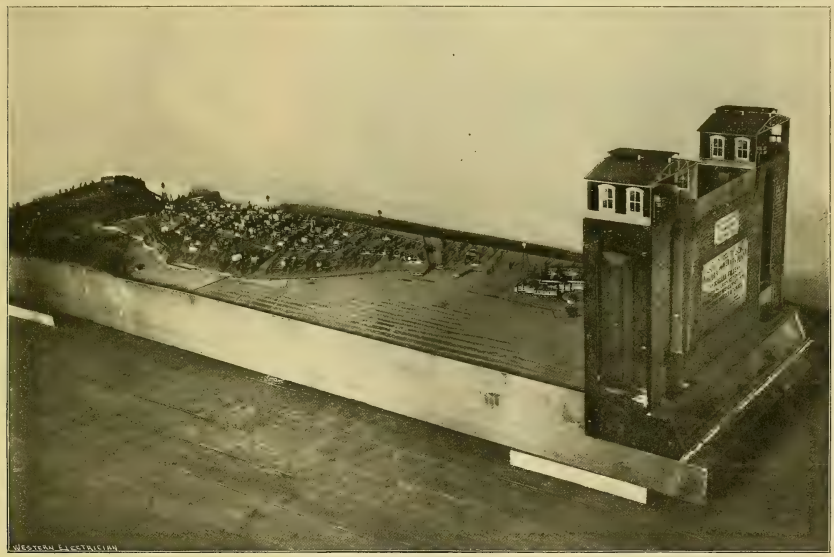



FIG. 1. NIAGARA MODEL FOR THE ELECTRICAL EXPOSITION. BIRD'S-EYE VIEW SHOWING THE CITY OF NIAGARA FALLS AND THE UPPER NIAGARA RIVER IN MINIATURE

the south side of the model the glass ends. To this point the water flows underneath the glass, when it runs out and flows over a bed made of lead representing rock. Where the rapids are, the lead is wavy, and the rapids are shown distinctly. As the water passes over the precipice it drops behind rocks at the bottom and passes underneath the glass river bed of the gorge.

The model was made by George R. Allen of Philadelphia, and that part of it that treats of the power development was made under the supervision of Coleman Sellers, chairman of the Board of Engineers of the Cataract Construction company.

Among the buildings that attract great attention is the beautiful Cataract House, the central power station of the Niagara Falls Power company, the many buildings that compose the immense plant of the Niagara Falls Paper company and the various churches in that portion of the city shown. All these buildings are made of wood, excepting the Cataract House, which is of cardboard. Taken as a whole, the model is destined to give strangers a clear idea of what has been done to develop Niagara power.

Many years ago an enterprising man got up a model of the village of Niagara Falls and of the falls themselves. This model attracted much attention and was very interesting to tourists. One man was so taken with it that he bought it and carried it away with him. The

## National Electrical Exposition.

The most important announcement made by the management of the National electrical exposition this week is that all arrangements have been completed for the operation for the model of the Niagara power plant by electric current generated and transmitted from Niagara Falls to the exposition building in New York city. On this and the preceeding pages will be found an interesting article describing in detail this model and the method of operation. Two excellent half-tone reproductions of photographs of the model accompany the article, and from these the reader will be able to gain an idea of this most interesting feature of the exhibition. The completion of the electric power plant in Niagara, and the recent contract made by the city of Buffalo for the delivery of current within the city limits by June, 1897, make it appropriate that the work should be signalized in some way at the National electrial exposition in May. In the development of the idea of exhibiting this model it was thought that, as little power would be required to drive the turbines, it might be comparatively easy to switch on a modicum of current from the Falls plant and actually run the model with it; not as an ideal exemplification of what might be done, but more as a pretty *tour de force*. To assist the enterprise, General Eckert, president of the Western Union Telegraph company, authorized A S. Brown, the electrical engineer of the

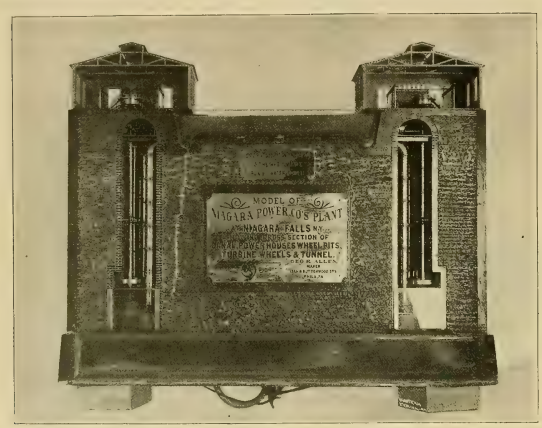



FIG 2 NIAGARA MODEL FOR THE ELECTRICAL EXPOSITION - END VIEW SHOWING THE NIAGARA POWER COMPANY'S PLANT IN MINIATURE

building of the tunnel enlarged the opportunities for the model maker to such an extent that Hon. Peter A. Porter had the model made. Although the tunnel plant has been in operation almost a year, and Niagaras of ink have been used in describing its wonderful features, it is surprising how few people appreciate and understand the method of development, but this model seems to make all clear at a glance.

## Patents of the National Conduit Manufacturing Company Sustained.

A decision by Judge Townsend in the United States Court, District of Connecticut, sustains the patents of the National Conduit Manufacturing company in its suit against the Connecticut Pipe Manufacturing company. The decision perpetually enjoins the Connecticut company from infringing the patents on cement lined tubes owned and controlled by the National Conduit Manufacturing company.

The case was argued by able counsel on both sides, and the decision is considered of great importance to the electrical public generally, on account of the many millions of feet of cement lined pipe already laid in the United States and Canada by the National Conduit Manufacturing company, and the large quantities which it is at present installing. This decision gives the National company complete control of the field, and additions to its already large factories are now in course of construction in order to meet the demands of the future.

company, to place two of the company's ordinary copper commercial wires at the disposal of the exposition for use every evening, say for an hour or so, when the weather conditions are normal. This generous offer evinces no small amount of public spirit, and does great credit to the company. L. B. Stillwell of the Westinghouse Electric & Manufacturing company has been asked to coöperate with Mr. Brown in working out the details, it being the intention to use the Tesla two-phase system and Tesla two-phase apparatus. A further suggestion is to hang some American Bell long-distance telephones over the exhibit and thus listen to the roar of Niagara while seeing the model driven by it. Steps are now being taken to realize this. Another idea suggested by Mr. Stillwell is to deliver some of the Niagara current to condensers and cable to Europe with it. Mr. Tesla is greatly interested in the whole project and is lending it his active assistance. At the opening exercises Governor Morton is expected to turn on the current of electricity which will be furnished from Niagara.

General E. S. Greeley has kindly consented to loan for the purpose of opening the National electrical exposition the gold telegraph key used by President Cleveland at the World's Fair in 1893. It is proposed that when Governor Morton closes the circuit through the key to the power plant, instead of signaling merely from floor to floor of the exposition building, a circuit shall first be made across the continent and back, through Chicago and San Francisco. The action will practically not be less instantaneous, but it will graphically illustrate the speed with which electricity travels. It is proposed also to fire a signal cannon in the same way, at the same time, to announce the event.

The United States Patent Office is arranging to make at the electrical exposition, a fine display of electrical models, etc., which will be peculiarly interesting and instructive as bearing upon the growth and development of electrical invention. A special representative of the Patent Office will be in charge of this exhibit, which will be under the general care of the historical and loan exhibit committee.

Mr. Edison is already actively engaged in preparing a select personal exhibit for the Exposition, and Luther Stieringer has kindly consented to take charge of the arrangement. In telegraphy, Mr. Edison will show stock printers, the phonoplex, the quadruplex, American district system, train telegraphy and the rote recorder, his first invention. In telephony, several varieties of apparatus will be shown, including microphones, the chalk transmitter, motograph receiver, etc. He will also show his interesting megaphone, odophone, etc. In lighting, Mr. Edison's earliest incandescent lamps will form a prominent feature, and the first converter, models of systems of distribution, multiple carbon lamps, center-pole lamps, first chemical meter and platinum lamp and early fixtures will be exhibited. In the line of power transmission, Mr. Edison will exhibit some very early motors and models of great interest. Among miscellaneous exhibits may be named the pyromagnetic motor, etheroscope, tasimeter, stages illustrating the evolution of the bamboo filament, magnetic friction devices, early phonographs, the fluoroscope and the latest form of phonograph. There are also in course of construction four sets of apparatus with which experts from his own staff will give exhibitions of the Röntgen phenomena, so arranged that by using the fluoroscope, people can inspect their own anatomy. The Crookes tubes will be mounted in connection with mercury pumps, so that in a rough way the process of lamp exhaustion will also be demonstrated. Mr. Edison's personal exhibit for the historical section, consisting of 40 cases, has been received at the exposition building.

## Western Delegation to the National Electric Light Association.

The announcement of the arrangements for a special train from Chicago to New York for the western delegation to the National Electric Light association in the last issue of the WESTERN ELECTRICIAN has been favorably received, and already there is evidence that a large number of central station managers in the vicinity of Chicago will take advantage of the opportunity to make the trip in congenial company. Of course there is no question about a large delegation from Chicago, as everybody who can spare the time will undoubtedly avail himself of this opportunity. The gentlemen in charge of the affair are now completing arrangements for delegations from other western cities joining the Chicago party either in this city or at some convenient point along the line. Representatives from all the northwestern states will undoubtedly come directly to Chicago and start with the party from this city. It is believed that every city of any considerable size in this section will have one or more representatives in the party, and many of the smaller towns have already been heard from. The management of the exposition is very much gratified with the outlook and is coöperating with the association in offering inducements to central station men and dealers to attend the New York meeting.

Bryan & Humphrey of St. Louis report that the C. & A. railway has made arrangements to take the St. Louis party to Chicago and return for one and one-third fare on the certificate plan. The St. Louis delegates will start for Chicago Friday night, May 1st, at 11:30 o'clock, reaching this city at 8:30 o'clock Saturday morning. This will enable them to spend several hours in Chicago before starting for New York.

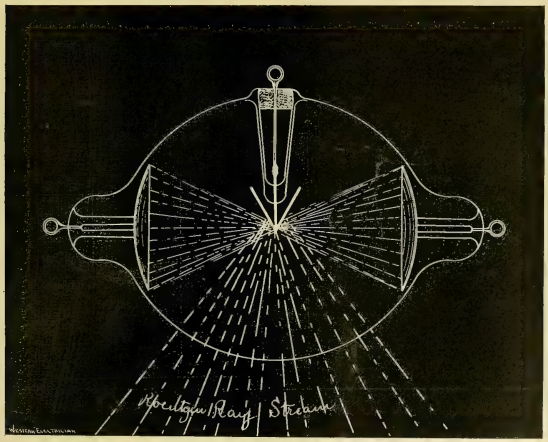
J. C. Hobart of the Triumph Electric company of Cincinnati and Joseph E. Lockwood of the Michigan Electric company of Detroit have been selected to take charge of transportation matters for their respective territories. These gentlemen will coöperate with the Chicago delegation, and it is believed they will contribute largely to the success of the expedition.

P. B. Shaw, who has organized electric light companies in a number of towns and cities in Pennsylvania, has begun proceedings against the General Electric company of New York to recover $200,000 damages for alleged breach of contract. He says he acquired from the company exclusive rights on dynamos and electrical appliances.

## Proposed Standard Tube for Producing Röntgen Rays.

By Elihu Thomson.

The observations which have, up to this time, been made as to the source of Röntgen rays point to the fact that the cathode rays must strike some surface which then becomes the Röntgen ray source. My own observations make me think that if the bombarded surface is of such a dense metal as platinum, which does not fluoresce, the rays will be more energetic. Bearing in mind these observations and the fact that it is desirable to possess Crookes tubes which are of standard make and adapted for use with high-frequency apparatus, Ruhmkorff coils with oscillatory or uni-directional discharge, or with Wimshurst or Holtz machines, I have proposed as a standard tube one which is represented in the accompanying illustration. The structure consists of a bulb at opposite sides of which are mounted concave aluminum disks supported on wires sealed through the glass. The foci of these concave electrodes coincide, nearly, at the center of the bulb, at which point is located a V-shaped sheet of platinum, iron, a small piece of iridium, or other piece of metal. This could be supported in any way desired, but it may be suggested, as a convenience, that it be mounted on a third or middle terminal, so that it can be made an anode. In using this tube with high frequency currents the two cup-shaped terminals are attached to the source of electric currents, which alternately become cathode during the discharges and cause the Röntgen rays to be emitted from the apex of the platinum sheet or from the surface of the piece of metal placed at the common focus. With oscillatory currents from a Ruhmkorff coil the same connections may be used, and even when the discharges are uni-directional the connection of either cup-shaped terminal as a cathode makes the tube effective; but in this case the middle terminal may be made the anode and the other or cup-shaped terminal a double cathode, and thus give the greatest amount of cathode surface with but a short distance to be traversed by the discharges, while the sharpness of the focus and, consequently, the definition obtainable with the Röntgen rays, remains unimpaired. If the vacuum in such a tube is too low, it is also possible to raise it quickly by constituting the middle terminal a cathode for a time, in which case metal would be carried therefrom and deposited on the side of the bulb in a very fine state of subdivision and quickly absorb the residual gas. If during the working of the tube the vacuum becomes too high, it can sometimes be reduced by simply heating the tube to a high temperature.



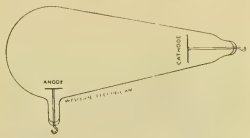

PROPOSED STANDARD TUBE FOR PRODUCING RÖNTGEN RAYS.—PROFESSOR THOMSON'S DESIGN.

The *Washington Times* thinks that the Edison fluoroscope will be immensely popular as an opera glass attachment behind theater hats.

## On the Best Shape for the Röntgen Ray Tube.

By W. M. Stine.

This subject has as yet received but little attention. Most experimenters have been compelled to use such Crookes tubes as were already in possession, or which could be purchased. The various incandescent lamp companies have, with commendable enterprise, begun the manufacture of tubes. No doubt experience is as yet too recent to give such tubes permanent shape, yet a discussion of tube designs may not be devoid of interest. The writer, through a series of fortunate circumstances, has been enabled to test a large number and variety of




ON THE BEST SHAPE FOR THE RÖNTGEN RAY TUBE.—PROF. STINE'S DESIGN.

Crookes tubes, and to have had the services of a skilled glass-blower, William Bohm of Chicago, to construct very successful bulbs.

The accompanying diagram illustrates the design which I have adopted as a standard. In general shape it resembles the usual pear-shaped Maltese cross Crookes tubes. The following reasons have governed its design: It has been clearly demonstrated that the Röntgen ray is generated on the bombarded walls of the tube,[1] chiefly opposite the cathode. But if the cathode stream impinges on a small area the tube becomes so highly heated, even with moderate excitation, that there is danger of breaking it down. It is also known that the rapidity of a tube is largely increased by the use of very high potentials. A further fact is significant—the cathode stream diverges to some extent as it proceeds radially from the cathode. A long, free path for the stream is thus advisable, so that the area of bombardment may be several times the diameter of the cathode disk. The tube will then withstand very high potentials without unduly heating. The end of the bulb may be either spherical or flattened; the latter is preferable if the tube is intended for long-range work. The bulbs should be from eight to nine inches in length and about four inches greatest width. The cathode may be one-half to three-quarter inch in diameter, and should be perfectly flat, since a concave shape dangerously concentrates the stream. The neck, where the cathode is placed, should not exceed one inch diameter. This is to prevent the gas molecules from passing back of the cathode to any extent. Should they do this, the back becomes highly active, wasting the energy which would otherwise be spent in the main stream. For this reason the usual spherical bulb is to be condemned. In such bulbs the cathode is set some distance within the bulb, the back becomes active, and the tube behind it is intensely heated. One of the leading features of the design illustrated is the use of a large, flat disk for the anode instead of the usual wire. The anode should be at least 1¼ inches in diameter. This is for the purpose of exhausting the tube electrically, the gas being probably occluded by the metal of the anode. By maintaining a constant polarity of the electrodes and using a constant polarity coil, the vacuum in such a tube is greatly increased, so that it soon becomes extremely active, even should the tube at first exhibit marked violet light. This is shown by reversing the polarity, when at once the tube exhibits its initial low vacuum light. The anode may be set further up toward the neck of the tube, if desired. It is well to have a small handle on the bulb, to hold it in a desired position.

As to the metals for the electrode, only aluminum should be employed, since it is the least volatile of the metals. Platinum is to be avoided, since Lenard has shown that though aluminum is scarcely volatile in the cathode stream, platinum is 44 times as liable to volatilize. If platinum is used, the walls of the tube soon become darkly coated with its deposited particles. Finally, the kind of glass used in the bulb seems to be of little consequence, for its activity does not seemingly depend on the amount of fluorescence present. Lead glass is not desirable, since it is quite opaque to the passage of the rays from the interior.

Some interesting results have been obtained with such a tube. Using the fluoroscope, a bullet in the calf of the leg has been clearly located. All the bones of the arm and lower leg can be readily seen, and indications point that the trunk of the body may be clearly examined by using still higher potentials. A coin has already been seen through 12 inches of pine wood. An excellent sciagraph may be obtained in from one to three minutes, or even less time.

1. Western Electrician, April 4, p. 158.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

A local company was being formed at Eldora, Iowa, to put in a telephone system, but on the promise of the Iowa Union to put in a first-class system at moderate rental if the project was dropped, it was abandoned. The Iowa Union promptly began work on an exchange and will soon have it in operation. The rates are to be $1.25 and $1.50 per month, and the people there say that if any raise in rates is made they will go ahead with the local exchange.

The Northwestern Telephone company has secured a franchise at Racine, Wis.

The Northwestern Telephone Exchange company has closed contracts for 800 miles of poles and 3,200 miles of wire for its long-distance extensions for this year. By December 1st it is expected that Minneapolis and St. Paul can talk with Fargo, N. D., and with Sioux City, Iowa, and Sioux Falls, S. D. Charles J. Glidden, Russell Robb and Charles P. Cummings of Lowell, Mass., of the Erie Telephone & Telegraph company at Lowell, are in Minneapolis on a tour of inspection of the system in the Northwest.

The Reinbeck Telephone company of Reinbeck, Iowa, has been incorporated with $3,000 capital stock.

The Northwestern Telephone Exchange company is arranging to connect with Windom, Minn., and work will be begun about May 1st. The right of way is being secured.

Business men of Wayland, Iowa, have subscribed $300 to secure telephone connection with Mount Pleasant.

The ndependent telephone companies in the vicinity of Jefferson, Iowa, are energetic. The Jefferson Telephone company will extend lines north, and the Perry company is arranging to connect with Guthrie Center and other towns. The managers of the Jefferson and Boone Telephone companies are arranging to connect the two counties and operate the line jointly. The Iowa Union (Bell) is figuring on a line north from Grand Junction to Fort Dodge.

The Western Electric Telephone company will build a line from Preston, Minn., to Cresco, Iowa, if the farmers on the route will subscribe sufficiently to justify it.

## Model Factory Electrically Operated.

In the factory of the Northern Electrical Manufacturing company at Madison, Wis., is found a practical application of the principles which this company is promulgating; that is, the transmission and utilization of electric power in shop work. The company has a model plant, equipped during the last year, entirely operated by electric motors. The main building is 150 feet long by 100 feet wide, and so arranged that it may be extended to the length of 500 feet. The power house is adjacent and separate from it, so that no fire will be used in the main building, the main shop being heated by steam supplied from the power house. An excellent exterior view is presented in Fig. 1. A railroad track runs through the center of the building, and is connected by a switch in the rear with the Chicago, Milwaukee & St. Paul railroad. This is shown in the interior view presented in Fig. 2. All the supplies which are to be brought in by rail may thus be deposited in the shop at the most convenient place for manufacture, as well as the product be carried away. All heavy castings are unloaded directly in front of the machine tools on which they are to be finished. The entire shop is so arranged that each piece as it passes through the various steps of manufacture moves progressively forward from one machine to the next until it is finished and ready to fit into its place in a completed motor, or go into the store-room. Another excellent feature is the provision made for moving and handling heavy machinery by a large traveling crane. All machines are driven by motors manufactured by the company. Current is furnished from the mains of the Four Lakes Light & Power company. The interior view of the factory (Fig 2) shows motors bolted to posts driving short line shafts. This feature is more clearly shown, however, in Fig. 3. A special advantage in the company's motor is here forcibly illustrated, namely, its adaptability to any service that may be required. It is so designed and constructed that it can be fastened to the ceiling or wall and operated without interfering in any way with the bearings, as readily as if placed upon the floor.

The factory, it should be noted, was especially designed for the most economical production of motors and dynamos of medium sizes, such as are in greatest demand. The plant has been laid out and the equipment put in with the sole purpose of reducing the prime cost of manufacture to the lowest possible limit. The company is thus enabled to put in the very best material obtainable. Arrangement has been made for the production of 12 sizes of machines, and a suitable machine tool has been provided for every operation to be performed. These machine tools are fitted with special tools, fixtures, chucks, cutters, etc., of the most elaborate description. In fact, nothing has been omitted that tends toward reduction of cost or greater perfection and uniformity in the finished product. It is evident that the problem of economical manufacture has been very carefully studied in this plant, which is very compactly arranged and has a capacity of about 100 machines per month. The intention of the company is to carry large lots of machines through at a single time in order to develop the full manufacturing advantages of the machine tools and fixtures provided, as well as to enable the company always to carry a large stock of finished machines ready for shipment. The workmanship of the machines is fully equal in quality to the best machine tool work, and the electrical work is kept to the highest possible grade.

The company has now ready for the market standard

FIG. 1. MODEL FACTORY ELECTRICALLY EQUIPPED.—EXTERIOR VIEW.

motors varying from one horse power to 75 horse power, wound for 110, 220 and 500 volts. Mention has already been made of the fact that these motors are so designed and built that any machine can be bolted to an ordinary foundation, or bolted to a wall or ceiling without taking off or applying any special parts, that is, any machine in stock can be applied in any one of the three positions by merely changing eight screws. To show the popularity of this system of driving it is merely necessary to state that more than two-thirds of the machines sold are bolted either to a wall or to the ceiling. Each size of machine built is also furnished as a generator. Two types of machines are illustrated in Figs. 4 and 5, a 75 horse power steel-clad dynamo and a steel-clad motor directly connected to a tannery pump. In addition to the standard motors the company is about to bring out several novel applications of electric motors, the first of which is a new method of driving line shafting for shops, mills and factories, which possess many advantages. It hopes also soon to have ready for sale an application of standard motors for the purpose of driving machine tools, such as lathes, planers, milling machines, drill presses, etc. This device, it is promised, will comply with all the conditions met in machine shop practice, the designer having had 15 years' experience as a practical machinist and in charge of shops.

FIG. 2. MODEL FACTORY ELECTRICALLY EQUIPPED.—INTERIOR VIEW.

In addition the company has nearly ready for the market a line of electric hoists to take the place and do the same work as is done by pneumatic hoists. These hoists will be built in four sizes, to lift 500, 1,000, 2,000 and 4,000 pounds and to lift four, six and eight feet. They are of strictly original and effective design and will without doubt supplant the pneumatic hoist.

## Transmission of Power in Factories.

By J. J. Flather.

For short distances shafting is usually employed to transmit the power from the prime mover to the machinery of a mill or factory, but the friction of such shafting effectually debars its use for any considerable length. Even with bare shafting this distance is not very great. With an efficiency of 75 per cent. the distance is only about 600 feet for a two-inch shaft.

In the ordinary transmission of power by shafting, we find the shaft loaded with pulleys and the power taken off in varying amounts throughout its entire length; it is unusual except in short lengths to receive the power at one end and transmit it at the other. The friction will evidently be proportional to the weight of the shaft and the unbalanced belt pull acting on the shaft.

The weight of pulleys, belts, clutches and couplings carried by the line shaft will vary from about one and a half to three times the weight of shaft, so that the total weight on the bearings will vary from two and a half to four times the weight of shaft; for head and jack shafts the weight will probably vary from three to five times the weight of the shaft.

In addition to the weight there is the unbalanced belt pull which increases the load on the bearings. Moreover, the actual power transmitted by a shaft is seldom more than three-fourths, and usually not more than one-half, of its working capacity; therefore the percentage of loss is very high. For well constructed shafting with hangers sufficiently close to prevent undue deflection under working conditions, good alignment, having long and well lubricated bearings, it can be shown that the loss in a two-inch shaft 200 feet long, running at 100 revolutions per minute, will vary from 10 to 20 per cent. of the power transmitted.

No matter how well a long line of shafting may have been erected, it soon loses its alignment and the power necessary to rotate it is increased. In one case[1] which is on record, a loss of 93 per cent. occurs in the transmission of the power from the engine to the machines.

By referring to the following table which has been compiled from data obtained from a number of representative machine shops[2], it will be noticed that the loss of power varies between wide limits, but in all cases the mechanical loss is large, averaging over 41 per cent.:

HORSE POWER—FRICTION.

| Name of Firm. | Nature of Work. | Horse Power. | | | |
|---|---|---|---|---|---|
| | | Total. | Req'd to drive shafting. | Req'd to drive machine. | Per cent. req'd to dr. shafting |
| Union Iron Wks. | Eng. min'g mach'ry. | 100 | 95 | 305 | .23 |
| Front'r I. & B. Works. | Marine eng's. etc. | 25 | 8 | 17 | .32 |
| Baldwin Locomo. Works. | Locomotives. | 2,500 | 2,000 | 500 | .80 |
| W. Sellers & Co. (one section) | Heavy machinery. | 102.45 | 40.89 | 61.56 | .40 |
| Pond Machine Tool Co. | Machine tools. | 180 | 75 | 105 | .41 |
| Yale-Towne Co. | Cranes and locks. | 135.05 | 66.81 | 68.24 | .49 |
| Ferracute Mach. company. | Presses and dies. | 35 | 11 | 24 | .31 |
| Bridgeport Forge company. | Heavy forgings. | 150 | 75 | 75 | .50 |
| Hartford Machine Screw Co. | Machine screws. | 100 | 100 | 900 | .25 |

J. T. Henthorn, in a paper read before the American Society of Mechanical Engineers, states that the friction of the shafting and engine in a print-mill should not exceed 19 per cent. of the full power. Out of 55 examples of a miscellaneous character which he has tabulated, seven cases are below 20 per cent., 20 vary from 20 per cent. to 25 per cent., 15 from 25 per cent. to 30 per cent., 11 from 30 per cent. to 35 per cent., and two above 35 per cent., while the average of the total number is 25.9 per cent.

Mr. Barrus, speaking of this subject, quotes eight cases, the data of which were obtained from tests made by himself in various New England cotton-mills, in which the minimum percentage was 18, and the maximum 25.7, the total average being 22 per cent.

In machine shops with a line of main shafting running down the center of a room, connected by short belts with innumerable countershafts on either side, often by more than one belt, and, as frequently hap-

1. Locomotive Shops of the Railway of Northern France.
2. *American Machinist*, November 6, 1890.

pens, also connected to one or more auxiliary shafts which drive other countershafts, we can see why the power required to drive this shafting in machine shops should be greater than that found in cotton and print mills, the machinery of which is in general driven from the main lines of shafting. Nor can we neglect the loss due to belts upon loose pulleys, as with the numerous clutches and countershafts in use the conditions more nearly approach those which exist when the machinery is in operation. There is no doubt, however, that a large percentage of the power now spent in overcoming the friction of shafting in ordinary practice could be made available for useful work if much of the present cumbrous lines of shafting were removed.

Manufacturers are realizing the enormous loss of power which ensues from the present system of transmission, and we find a general tendency to introduce different methods by which a part of this loss will be obviated. Among these are the introduction of hollow and lighter shafting, higher speeds and lighter pulleys; roller bearings in shaft hangers, and the total or partial elimination of the shafting.

A large number of prominent manufacturers are driving their machines direct by means of electric motors, and we find their use has invariably been attended with economic results.

For isolated machines and for heavy machines that may be in occasional use, the electric motor is particularly well adapted, as such a means of power transmission consumes power only when the machine is in operation.

For the average machine shop, short lengths of light shafting may be employed to good advantage, and the various machines, arranged in groups, may be driven from one motor. By this method fewer motors are required and each motor may be so proportioned to the average load that it may be run most of the time at its maximum efficiency. When short lengths of shafting are employed the alignment of any section is very little affected by local settling of beams or columns, and since a relatively small amount of power is transmitted by each section, the shaft may be reduced in size, thus decreasing the friction loss. Moreover, with this arrangement, as also with the independent motor, the machinery may often be placed to better advantage in order to suit a given process of manufacture; shafts may be placed at any angle without the usual complicated and often un-

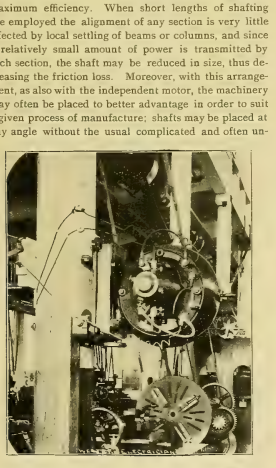


FIG 3. MODEL FACTORY ELECTRICALLY EQUIPPED.—STEEL-CLAD MOTOR BOLTED TO POST AND DRIVING LINE SHAFT.

satisfactory devices; setting-up room may be provided in any suitable location as required without carrying long lines of shafting through space. This is an important consideration, for not only is the running expense reduced thereby, but the clear head-room thus obtained, free from all shafting, belts, ropes, pulleys and other transmitting devices, can be more easily utilized for hoists and cranes, which have so largely come to be recognized as essential to economical manufacture.

There is also less liability of interruption to manufacture, on account of the sub-division of power, and in case of overtime it is not necessary to operate the whole works with its usual heavy load of transmitting machinery.

Another advantage is the adaptability of the system to changes and extensions; new motors may always be added without affecting any already in operation, and the ease with which this system lends itself to varying the speed of different unit groups is a very potent factor in its favor.

On account of the excessive friction loss in factory shafting, there is a general opinion that a large amount of power is required to drive the machinery, but such is not the case with the average machine tools in common use working under their ordinary load.

In estimating the power required to drive a given machine or group of machines the accompanying table may be used very satisfactorily as a guide and may be considered to represent fairly well the power required to operate the machines designated.[1]

It will be noticed that the friction load varies between wide limits in some of the machines, but this is what

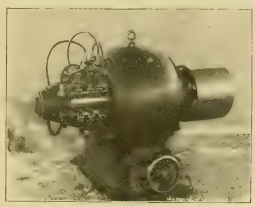


FIG 4. MODEL FACTORY ELECTRICALLY EQUIPPED 75 HORSE POWER STEEL-CLAD DYNAMO.

we should expect in those machines having a variable speed and rate of feed.

The average load will usually be much less than that here given for full load, and may often be taken equal to or less than half the value in the table. On the other hand, some machines may be crowded so that double the loads here given are considered as the regular working loads, but these conditions are rarely met with and we find usually that a machine is not worked up to more than half the capacity as given in the table.

IRON-WORKING MACHINERY.

| Name of Machine. | Full Load. | Friction Load. |
|---|---|---|
| Small screw cutting lathes, 12" to 15" | ¼ H. P. | ⅛ to ⅓ H. P. |
| Lathes from 16" to 24" | ½ " | ⅛ to ¼ " |
| Lathes from 24" to 36" | 1 " | ¼ to ½ " |
| Facing lathes, 60" to 72" | 2 " | ½ to 1 " |
| Wheel lathes, 60" to 84" | 3 " | 1 to 1½ " |
| Shapers, 15" to 18" | ¾ " | ⅛ to ⅓ " |
| Planers, 24" to 36" rack and gear | 2 " | ½ to 1 " |
| Large planers, 60"x60" up to 70x70" | 10 " | 2 to 4 " |
| Small drill press | ¾ " | ⅛ to ¼ " |
| Medium drill press | 1½ " | ¼ to ½ " |
| Radial drill | ¾ " | ⅛ to ¼ " |
| Slotter, 13" stroke | 2 " | ½ to 1 " |
| Punch press, 28" throat punch, 1"2 stock | 4½ " | 1 " |

WOOD-WORKING MACHINERY

| Name of Machine. | Full Load. | Friction Load |
|---|---|---|
| Wood planers, 24" to 28" | 3 to 5 H. P. | 1"2 H. P. |
| Matchers, 14" by 5" | 2 " | ½ " |
| Circular saws, 24" to 36" | 5 to 6 " | ¾ to 1¼ " |
| Band saws, 36" band wheel | 1 " | ¼ " |
| Tenon and mortising machine | 3 " | ¾ to 2 " |

GRINDSTONES AND EMERY WHEELS.

| Name of Machine. | Full Load. | Friction Load. |
|---|---|---|
| Grindstone for tools, 30" diameter | 1½ H. P. | ¼ H. P. |
| Grindstone for stock | 3 " | ¼ " |
| Emery wheels, 6" to 12" diameter | ½ to ¾ " | ¼ to ½ " |

1. Extra heavy machines may require two per cent. more power for maximum output.

When individual motors are used with each machine the horse power of the motor should be at least equal to that given in the table under full load, but when the group system is used there will usually be ample power if motor capacity be provided equal to one-half of the total power required to drive all the machines in the group at full load. If but two or three machines are run in a single group and these be in daily use, then about two-thirds of the total full-load capacity should be provided in the motors.

The generator capacity can be determined in a similar manner, but in the latter case allowance should be made for drop in the line and loss at the motor.

It is interesting to note that in recent tests made at the Baldwin Locomotive Works it was found that with a total motor capacity aggregating 200 horse power, a generator of only 75 kilowatts was sufficient to furnish the current, and ordinarily only 60 kilowatts, or 40 per cent., is required.

1. See paper by the writer in *American Machinist*, April 12, 1894, giving results of tests on about 60 different machines.

## Should Municipalities Undertake Business Enterprises?

From the Rochester, N. Y., *Post-Express*.

The Board of Supervisors are now considering whether the county shall purchase an electrical plant and furnish light for the new court-house, and in connection with this discussion, it is suggested that the city in time might undertake a similar enterprise.

We do not care to consider the probable financial results of this particular measure, but it suggests some reflections on the broad question of public control of business enterprises. Many believe that it would be well if municipalities or the general government would not only take charge of such local industries as furnishing light and running street cars, but would also assume control of the railroad and telegraph systems of the country.

There are reasons why such views should find advocates. Large is the number of those who constantly turn to the government for help and cherish a vague belief that the state could carry their freight at the lowest rates and furnish them light and telephone facilities in the best manner and at the least cost. Those who take an active part in politics see their advantage in such a development of government activity; even the honest may view with complacency the increase of political patronage, and for the dishonest there is a greater possibility of illicit gains.

But experience shows that whoever may profit by government control of business enterprises, it is not the public. It is easy to say that if individuals reap a benefit from such undertakings, the public can do the same, but this by no means follows. There is no business of which the profit is sure; where gain results, it is because the enterprise is managed with judgment, with intelligence, and with economy, and, most important of all, because it is managed by those who have their own money at stake.

In all these respects the government is at a disadvantage; its servants are constantly changing, and they assume a brief charge of industries to which they have not given their lives; the only margin of profit is by a rigid economy of operation, and until human nature changes there will be few who insist upon economy when the public is the paymaster. It is for these reasons that, with few exceptions, when the government assumes control of a private enterprise, the public gets poorer service at higher cost. This is not a matter of speculation; it has been demonstrated by experience. Many of the railroads in Europe are owned by the government, and he must be a dull traveler who does not discover that he pays more than here and gets poorer service. There the average price of railroad travel is not far from four cents a mile and here we pay two; on third-class cars one can indeed travel for two cents a mile, but he is huddled into a small compartment with 10 or 12 people, and usually with a bare board for a seat. The great speed which competition has secured for the public is unknown where competition cannot act. Thirty or 40 miles an hour is exceptional, and the traveler may be thankful if he is carried even with that rapidity. No government furnishes an Empire State express running at 55 miles an hour.

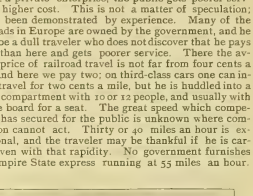


FIG. 5. MODEL FACTORY ELECTRICALLY EQUIPPED. STEEL-CLAD MOTOR DIRECTLY CONNECTED TO TANNERY PUMP.

Here for $2 one has a sleeping car to New York and for $3 to Chicago; for sleeping car accommodation in Europe for the same distance he would pay from $8 to $15. When we compare systems controlled by the government with our own railroads, which are exclusively in private hands, we find that we are carried quicker, cheaper, and with greater comfort.

We may turn to smaller enterprises, but we shall find the same results, for the same principles are involved; the government pays more for what it buys and more to those it hires than a private individual. Nor do the holders of political office always exhibit qualities which suggest the wisdom of increasing their responsibilities; if the United States Senate frequently injures business interests, so far as its influence extends, why should we be eager to increase its power to harm?

There are a few English and Scotch towns which have enlarged the scope of municipal action with advantage to the citizens; they are exceptionally situated and exceptionally governed, and even in their case it is for the future to show whether an extraordinary degree of public vigilance will continue and will cure the evils inherent in municipal control of business enterprises.

The Martin Telephone company of Webster City, Iowa, will build a line to Waterloo, via Alden, this season.

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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## HIGH WATER MARK

CIRCULATION, 16,630.

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THE publication offices of the WESTERN ELECTRICIAN have been removed to much more commodious quarters Our new address is Suite 510 Marquette building, Dearborn and Adams streets, Chicago.

The telephone number remains unchanged—Main 1746.

COMPULSORY arbitration is once more brought prominently forward by the differences between the Metropolitan Street Railway company and its employés, and the passage of a bill now before the Legislature is urged by the New York daily press as the only method of protecting the public against the annoyances and inconveniences of a strike on the great street railway systems of the metropolis. It is contended that railway service is public service and cannot be suspended or interrupted without intolerable inconvenience to the community; that it should be maintained without any cessation or interruption that can be avoided, and further, that the state not only has the right, but it is its duty, to see that this is done. In view of the fact that a prominent street railway magnate of considerable influence in the political world, as well as in financial circles, has become an avowed champion of compulsory arbitration, there seems to be no good reason for anticipating opposition to any measure that will properly recognize the property interests involved.

THE last municipal election in Chicago resulted in the enforced retirement from the common council of several statesmen of unsavory reputation. It has not yet been demonstrated that the new council is an improvement over the last, but it is generally admitted that it could be no worse, and that any change would in all probability be for the better. There has been so much talk about boodle in connection with the official action of the city's representatives of late years, that the public is evidently disgusted with the entire administration. A general cleaning out would be welcomed.

PRACTICAL men demand practical information upon practical subjects. All these conditions are met in the paper presented on another page upon the "Transmission of Power in Factories," by Professor Flather. It is addressed to practical men, not necessarily experts or engineers, although these latter will find in it much information of value; and the subject is treated in such a simple manner that any person engaged about a factory or interested in its operation will readily comprehend it. The article presents the result of Professor Flather's experience, and while his deductions may not be accepted by all, his views should receive the consideration to which the valuable and varied experience of the author entitles them.

TWO very important contributions on the subject of the form of tube most desirable for producing X-rays are presented elsewhere in this issue. Accompanying these articles are drawings, prepared by the authors, illustrating the principal features in the design and operation of the special form of construction which each advocates. It is rather strange that so little attention has been given this important subject, as is indicated by the dearth of literature on this feature of the Röntgen experiments, for it is one of the most interesting as well as important subjects to be taken into consideration in these investigations. It is evident that Professor Thomson and Professor Stine have given the matter much thought and study, and the results of their investigations and experiments, which they present on another page this week, should command attention, but other investigators, working along different lines, may reach conclusions at variance with theirs, and as the subject is one of such great importance it should be carefully considered from every viewpoint.

WE commend to the careful consideration of our readers the article on governmental control of industrial enterprises which is reprinted on another page from the Rochester *Post-Express*. It is a pleasure to find this subject is receiving the consideration of intelligent men who will investigate the problems presented and not take for granted the wild utterances of demagogues and politicians who are actuated by a desire to gain notoriety or command patronage. There is no danger to private capital as long as this class of men can be interested in the subject. It is only through indifference on the part of the public, apathy among business men and failure to realize the importance of the subject and the principle involved, that municipal ownership and governmental control can hope to succeed. The lessons which the failures and abuses attending experiments in this line have taught the public have resulted in a growing interest in the problem, and the advocates of these socialistic plans will find it much more difficult to secure the adoption of their schemes, now that the common sense of the community is beginning to be exercised.

AS AN engineering and commercial problem the development, transmission and utilization of the power of Niagara continues to occupy a position of first importance. Nor has public interest in the subject abated. It seems rather to have been revived and intensified by the recent discussion in the New York Legislature over the plans of the power companies and the effect that the establishment of these industrial enterprises at the Falls would have upon the natural beauty of the scene. The people of the Empire State are very proud of their magnificent state reservation, as they have a right to be, and they are very jealous, too, of any encroachment by the power companies that would jeopard the beauty of the park and Falls. The article and illustrations which form a prominent feature of this issue, give an excellent idea of what has already been done at Niagara. The model which is here described will be an attraction at the electrical exposition at New York next month, and there is no doubt that as an educational feature it will be very valuable. It is really surprising how little exact information is possessed by the people at large upon the subject of the Niagara power plant, although, as Mr. Dunlap says in his article, Niagaras of ink have been employed in describing its varied features. This model will afford an excellent opportunity of illustrating the operation of the plant; it will be an object lesson in the utilization of water power for electrical transmission, and it will give a better idea than could possibly be conveyed in any other way of the work that has already been accomplished at Niagara Falls.

DOWN in Texas the central station men are occupied with their plans for the second annual meeting of the Texas Gas and Electric Light association. This organization is similar in some respects to the state associations formed several years ago under the auspices of the National Electric Light association; many of its members are also members of the National association and the plans and objects are similar. No doubt many of the companies forming the Texas organization would hesitate about sending a representative to the convention of the National Electric Light association at New York next month on account of the expense involved, although we believe it would pay every central station company in the country to have its superintendent and manager at that meeting. It would be very appropriate, however, for that section of the country to show its interest in the national organization, its aims and policy, and we suggest that the executive committee name a representative of the association to attend the New York meeting.

The Northwestern association should do likewise, even though many of the companies comprising that organization will have their own representatives. It will show that the organization as a body has the proper spirit and interest in the general industry.

This meeting promises to be one of the most important that has ever been held in the interest of the electrical industry, and it should be taken into consideration, too, that the West has a special interest in its success, as the chief executive officer of the association is a western man. Let the Northwest and the Southwest and the Pacific coast states join with the Middle and Eastern states in making the New York convention the most successful in the history of the organization.

ONLY a favored few can indulge in the luxury of building for personal use electric launches and electric yachts, and those who have the means do not evince an inclination to contribute to the development of craft of this type. John Jacob Astor may be considered an exception to this rule. His fondness for yachting and his aptitude for electrical and mechanical work have led him to undertake quite extensive experiments in this line. His first practical result was the construction of an electric launch several years ago, a small mahogany boat equipped with storage batteries. After considerable experience with this boat and as a result of his experiments, Mr. Astor built a second launch similarly equipped with storage batteries. The second was larger than the first and embodied many improvements. It was a 46-foot boat and attracted considerable attention at Newport last year. This success encouraged Mr. Astor to indulge in further experiment, and as a result he has, with the assistance of a prominent yacht designer, completed plans from which an electric yacht is now being built. This boat promises to be an innovation, and there is reason to believe that it will stimulate interest in electrically propelled craft. An idea of the importance of Mr. Astor's undertaking may be gained from the fact that the yacht now in course of construction is to measure 72 feet over all, 12 feet beam and four feet draught. Twin screws operated by two 50 horse power electric motors, supplied with current from storage batteries of sufficient capacity for 10 hours' run, and electric pumps, electric capstans, electrically controlled and operated center boards, electric lights and signals, are features of the equipment. It will be an electric yacht in every sense of the term, and, as befitting such a boat, its fittings and furnishings will be complete and costly. No wonder Mr. Astor expects to create a sensation at Newport this season.

## Niagara Power Privileges.

[From the Niagara Falls correspondent of the WESTERN ELECTRICIAN.]

Power matters are receiving more attention in New York state than in any other state in the Union. This is, perhaps, quite proper, seeing that the Empire State has in the Falls of Niagara the greatest source of power in America. The WESTERN ELECTRICIAN has told its readers of the power bills before the New York State Legislature, and also of the bill introduced to retire the present commission of the New York State Reservation at Niagara and place the control of this great free park in the hands of the State Game, Fish and Forest Commission.

Last week another step was taken in the battle that is being waged in the Legislature, when Senator Cantor presented a memorial on the subject of the aggressions of private power corporations at Niagara Falls. This memorial is in the form of a protest and includes an interesting summary of the valuable franchises which have been secured, and for which the state has received nothing. It is also designed to furnish cogent reasons for the defeat of Senator Ellsworth's bill legislating the present commission out of office, while it infers the suspicion that the power companies are behind Colonel Ellsworth's bill and that these corporations expect to get still further privileges through the State Game, Fish and Forest Commission. As to the latter suspicion, however, it may be said that the substantial power companies have about all they desire. Then the memorial recites the fact that when the present reservation was bought by the state, it was disfigured by unsightly structures and notoriously subjected to practices that were vexatious and marred the pleasure of visitors to the cataract. The commissioners remind the Legislature that the state acquired the property at great cost, with the object of removing these unsightly structures and of ending impositions upon the public. They ask if it is to be easier for schemes of the most prejudicial character to get a foothold in the reservation now that it is the property of the state than when it was under private ownership. Continuing, the commissioners, on the subject of power matters, say :

The numerous projects to take water from the Niagara river that have already received legislative sanction, and certain enterprises to utilize the more distant waters of the lakes, which were essential to the integrity of the Falls, have created a very general apprehension that the grandeur of the falls is to be impaired. Omitting details of more distant projects, those in the immediate vicinity of the Falls are the following:

First—The Legislature of 1886 incorporated the Lockport Water & Electric company, which claims the right to take water from the Niagara river in quantity unlimited and without any compensation to the state.

Second—The Legislature of 1891 incorporated the Niagara County Irrigation & Water Supply company, which claims power to take water in unlimited quantities and without compensation.

Third—The Legislature of 1888 incorporated the Lewiston Water Supply company, capital not to exceed $50,000,000, claiming power to take unlimited water without compensation.

Fourth—The Legislature of 1889 incorporated the Buffalo & Niagara Power and Drainage company, claiming power to take water without limit as to quantity and paying therefor nothing to the state.

Fifth—The Legislature of 1893 incorporated the Niagara Power & Development company, claiming power to take an unlimited quantity of water without paying anything therefor.

Sixth—The Legislature of 1894 incorporated the Niagara, Lockport & Ontario Power company, with a capital not to exceed $10,000,000, claiming the right to take unlimited water and without compensation.

Here are six concerns, which, while not yet taking water from the river, yet have such authority to do so as the Legislature can give. Another company, differing from those above mentioned, in that it is now actually drawing water from the river, is the Niagara Falls Power company, originally chartered by the Legislature as the Niagara River Hydraulic Tunnel & Sewer company, claiming under legislative action by a series of most remarkable acts, skillfully drawn, the most monstrous powers, which, it is safe to say, are not entirely in the public interest.

A committee of the late constitutional convention recommended the passage of a constitutional prohibition against diverting the waters of the Niagara from their natural channel, but corporate representation was too strong and active to prevent its passage. In an able report on this subject, this committee says respecting this Niagara Falls Power company: It is authorized to conduct, convey and furnish the waters of the Niagara river, or any power, heat or light developed therefrom, to, in and through any civil division of the state, and to sell, furnish and deliver the same to any and all bodies or persons, public or private, wherever situated, and for any such purpose said corporation from time to time may enter upon any private property for which it may obtain such right, or upon public bridge or street, highway, road, land or water, and may use the ground thereunder. If the company uses its full limit of 200,000 horse power, it will draw from the river about six per cent of the entire volume of water. In return for these immensely valuable franchises, the state of New York has not received one cent of any consideration, except the condition by the Niagara Falls Power company to furnish the Niagara Reservation with water and light (of which the commissioners of the reservation have not availed themselves).

To create a single horse power for 10 hours a day by other agencies than water, costs from $25 to $100 per annum. If it be entirely within bounds, $10 is taken as the value of one horse power per annum, to take 200,000 horse power would represent an annual value of $2,000,000.

Another company, the Niagara Falls Hydraulic Power & Manufacturing company, has been recently engaged in enlarging its canal without any legislative or other authority. It began to take water from the river many years before apprehension of injury to the Falls was generally entertained. The attorney-general has furnished the Niagara commissioners with an opinion that the taking of water by this company is without authority of law and that an injunction will lie against it. This company now comes to this Legislature for authority to continue to take water and to increase its take to 200,000 horse power; to those or to any authorization to take water from the river, the commissioners cannot consent.

Before closing the commissioners refer to the fact that a considerable sentiment exists in the vicinity of Niagara Falls in favor of enterprises that take water from the river, "as these add to the activities of the place and tend to advance the price of lots." But they ask if these local interests are to be gratified at the sacrifice of the very objects for which the state acquired the reservation property. They remind these local enthusiasts that the city of New York alone paid in round numbers one-half of the whole cost of the reservation and that the pecuniary interest which the people of Niagara Falls hold in the property is very small as compared with that of the rest of the state. Of the effect of this tendency of local enterprise, the commissioners say:

There can be no doubt that the Falls will be seriously affected by the numerous enterprises to utilize the waters that render the Falls the magnificent spectacle that they are. Just apprehensions have arisen on this subject, and it remains for the Legislature of the state to dispel those fears by discountenancing further permissions to divert these waters and by applying proper limitations to those concessions that have already been made.

On the subject of the bill intended to legislate them out of office, the remarks of the commission are modest:

They have, they say, enforced rules for the protection of the public from the excessive demands of persons granted the use of any and all privileges of the reservation, including carriage service, steamboat service and the privilege of conducting tourists through the Cave of the Winds, and, more than this, they have opposed all grants of the right to take the water of the Niagara river for private purposes. These, or some of these, interests, may be set up against the present commission. Naturally some disappointments arise from their fixed determination in this respect. The duty, however, was obvious, and the commissioners are quite ready to accept all the responsibilities and all the consequences. After years of service, with no other reward than that which follows a conscientious discharge of a public duty, the commissioners are not aware of any just criticisms of their work, nor upon the integrity or intelligence of its management.

Quite naturally, it is a fair inference to suspect that the power companies are favorable to the bill to oust the commissioners, for in this way they will rid themselves of the official opposition of President Green of the commission, who has been especially fierce in his antagonism of the power and industrial interests of Niagara. It is believed, with good reason, that not all the commissioners fully agree with him in the matter. Such has been President Green's enmity that, for all the franchise of the Niagara Falls Power company provides that it shall furnish the State Park with light and water, and it stands ready to perform its part of the contract, the commission has allowed the park lands to remain in darkness and regularly asks for its water bills from the Niagara Falls Water Works company, an allied company of the Niagara Falls Power company, thus clearly defining a depth of opposition.

A company just formed in Jersey City, N. J., has aroused a world of suspicion. This is the Mannessman Cycle Tube company, having a capital of $2,0c0,000. Of the capital stock, $1,000,000 is paid in, and the company is to commence business at once. Its main office is in Jersey City and a branch office will be opened in Buffalo. The incorporators are Robert Mannessman of Hoboken; Reinhardt, Alfred and Carl Mannessman of New York; W. H. Hill of Boston; Richard A. Burget of Pittsfield, Mass.; William V. Sherman of New York and Levi L. Brown and Emil Kipper of Adams, Mass. The purpose of the company, as set forth in the incorporating papers, is to dam rivers and streams, including the storage, transportation and sale of water and water power and privileges, with the right to take rivulets, raceways and lands and erect and maintain dams, reservoirs, raceways, mills and manufactories, and to close mortgages and sell and convey the same or any part thereof. For some reason it is announced that the true purpose of the company is to get control of Niagara Falls and utilize it for motive power. The same company a short time ago filed articles of incorporation for the establishment of a plant in Buffalo to manufacture tubular iron.

It has been intimated that the Cataract General Electric company is about to sell out its franchise rights on the canals of this state to an English syndicate, but this Frank W. Hawley denies in these words:

The equipment for the propulsion of canal boats by electricity upon the Erie canal will be owned and operated by Americans, and not by foreigners. When you appreciate the fact that the investment of $8,000,000 or $10,000,000 will establish upon New York's great waterway a transportation line equal to the total carrying capacity of the great trunk lines that parallel it with their hundreds of millions of dollars invested, you will see that is good enough property to be owned on this side of the Atlantic, especially where you have the advantage of the cheap power of Niagara.

Has any capital been offered you for the canal line?

Yes; we have had offers of all the capital we want. From many sources, but we have all we need at our command, and will construct the line and operate it for the benefit of the producers and consumers of the products of the great Northwest, and not in the interest of any railroad organization, as suggested in press dispatches.

## Contracts Awarded for Chicago's Storage Battery Road.

As the readers of the WESTERN ELECTRICIAN are aware, Chicago is to have the first railway in the country built exclusively for operation with storage batteries. Other roads in various parts of the country have been partially or even wholly operated by accumulators, but Chicago will have the distinction of having the first line built from the ground up as a storage battery road, and planned for such operation in every detail. The Englewood & Chicago Electric Railway company, which is backed and controlled by the Electric Storage Battery company of Philadelphia, has undertaken the task, and its work will be watched with much interest by every street railway man in the country. The experiment will certainly be painstaking and thorough and under the most favorable conditions. If it prove successful, financially as well as mechanically, it cannot be doubted that the new road will prove an example of great influence on the future street railway development of the country.

It will be remembered that in purchasing from the original owners a franchise for an electric railway in the southwestern part of Chicago and Morgan Park the Englewood & Chicago company secured little else, and so it was necessary to plan and build an entirely new system. The preliminary work has been progressing steadily in the offices in the Marquette building, and last week a number of contracts were let and others will be awarded in a few days. The actual work of building an extensive storage battery road is now under way. The contracts already let are as follows:

*Track Construction.*—C. E. Loss & Co., Chicago. This is for grading, ballasting, construction, etc., for 20 miles of track.

*Ironwork.*—Henry Levis & Co., Philadelphia. This contract is for furnishing the rails, spikes, etc.

*Car Bodies.*—St. Louis Car company. There will be 20 open cars and 20 closed cars.

*Engines.*—M. C. Bullock Manufacturing company, Chicago. At first two vertical Willans engines, each of 250 horse power, will be installed. These engines are of the triple expansion condensing type. Provision is made for additions.

*Electrical Machinery.*—Walker Manufacturing company, Cleveland. In the power house there will be four six-pole Walker generators, each of 250 kilowatts capacity. In addition, the contract includes 23 car equipments, each car having a 50 horse power motor and a Walker controller.

*Engine and Dynamo Connection.*—Arnold Electric Power Station company, Chicago. This contract allows the use of the Arnold system, by which the engines and generators may be connected in certain combinations otherwise impossible.

The Electric Storage Battery company's chloride accumulators will be used, as a matter of course. Seventy-two 9-T cells of about 400 ampere-hours each will be placed on each car truck, and these will furnish sufficient current to the motor to drive the car at a maximum

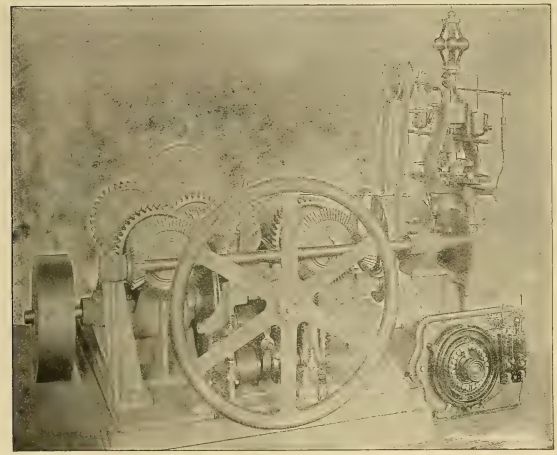
speed of 25 miles an hour. The entire equipment and construction of the road have been placed in the hands of G. Herbert Condict, with B. J. Arnold as consulting engineer. Mr. Condict is the chief engineer of the railway department of the Electric Storage Battery company and also general manager of the Englewood & Chicago Electric Railway company during the period of construction. It is hoped that cars will be running over the line by August 1st. President Shaffer has entered upon an extended European vacation.

## Giesler Electro-mechanical Water Wheel Governor.

The Stilwell-Bierce & Smith-Vaile company of Dayton, O., has taken the lead in developing the horizontal type of turbines and adapting them to the requirements of electrical generators. It has realized for a long time that no governing device for water wheels brought out up to this time was at all adequate to take care of the sudden and material changes in load and maintain a uniform speed. Formerly a variation of speed of five to 10 per cent. was permissible in ordinary mills. Now a variation of not exceeding one per cent. is desired. During earlier experiments efforts were directed to making a governor entirely electrical; that is, one which should use the change in the electrical current as a medium for governing the water wheel employed in generating that current; but the results were unsatisfactory. Very fair results were obtained by the use of a hydraulic piston, but there were objections to this form in actual practice, and they were expensive to build and maintain as well.

After experimenting in every direction, the company finally settled to the conviction that the form adopted, as shown in the accompanying cut, was decidedly the most desirable in every way. With this machine, the slightest variation in speed is instantly multiplied to any desired extent, and enables the opening or closing of the water wheel gate long before the ordinary balls, as used in other governors, would show any sign of moving. The governor can be arranged so as to fully open or close the water wheel gate in from three to 15 seconds, according to the requirements of the situation. The engineers of this company have been experimenting along this line for two years, sparing neither time nor expense, and their efforts have resulted in perfecting the Giesler electro-mechanical governor which has proved itself to be of such excellence as to entitle it to the pre eminence resting upon the sure foundation of demonstrated results.

The Stilwell Bierce & Smith Vaile company manufactures and sells these governors under a guarantee that they will perform all they are recommended to do. The makers are enabled to use very small balls in this governor, because the balls are relieved of doing any work whatever, such, for instance, as lifting a valve against pressure, lifting a gate or moving a slide, etc. The balls and their attachments are all balanced to the finest degree, and their movements magnified to such an extent that the slightest variation in centrifugal action will at once manifest itself by directly opening or closing the water wheel gate as required.



GIESLER ELECTRO-MECHANICAL WATER WHEEL GOVERNOR

## A Complete Insulating Plant.

The accompanying illustration represents the factory of the Safety Insulated Wire & Cable company, Nos. 225 to 239 West Twenty-eighth street, New York city. The building is a modern and sightly structure, impressive because of its size, but hardly giving an idea from without of the bustle and activity within. The factory takes up five stories, running the entire length of the building, and a basement.

In the basement is a large store-room for lead-covered cables, heavy cabling machinery for submarine and underground cables, lead presses for covering wires and cables for underground purposes, jute machines, large tanks for testing heavy cables, a mill room where the compound is made, and engine and boiler rooms, where there are a modern 300 horse power Whitehall-Corliss engine and two 200 horse power Stirling boilers. A 300 horse power Berryman heater, installed by Davis & Co. of Hartford, Conn., is included in the equipment. All the machinery on this floor, and, in fact, on all the floors, is of especial character and seems to do the work in the best possible manner, as far as economy and quick results are concerned. The mill room deserves more than a passing notice, for it is here that the pure Para rubber is broken down by many processes until it is in a uniform condition to receive the compound. If anyone should doubt the character and basis of the Safety compound, one glance in the mill room could not but be reassuring. Here the rubber is seen in its raw state. After it is broken down it is rolled out to the thinnest gauze and is perfectly transparent. Any imperfections or parts of rubber that have not been sufficiently worked under this process are clearly visible. When in perfect condition the compound is put in, and by processes which are just as careful a uniform product is the result.

On the first floor is the shipping and receiving departments, carpenter shop, electrician's office (which is fully equipped with modern testing intruments), the electrician's laboratory and tanks, the vulcanizing department and a stock room for bare wire of all sizes. On the second floor are the general business offices, private offices, directors' room bookkeeping department, superintendent's office and cabling and stranding rooms. The insulating department occupies the entire third floor. The fourth floor is devoted to the stock room for all insulated aerial wires and cables and to the waxing, twisting and taping department. On the fifth floor is the machine shop, cabling machines for small cables and the braiding department.

It would be hard to imagine a more complete insulating plant, and a visit to the Safety company's factory will explain why its product is so widely used. The plant is centrally located, being only two blocks west of Broadway on Twenty-eighth street.

The Safety Insulated Wire & Cable company has a well-known reputation for underground work, and some of its prominent contracts may be mentioned. It furnished to the Manhattan Electric Light company of New York 350 miles of underground cables. The People's Traction company of Philadelphia has purchased upward of 70 miles of 1,000,000 circular mils cable, the contract amounting to over $400,000. The Mt. Morris Electric Light company, New York, has in use 270 miles of Safety underground cables. The Boston Electric Light company has purchased 150 miles of lead-covered wire and cables. The Safety company furnished the cables, laid them, made all the joints and connections for the underground feeders for the West Chicago Street Railroad company, upward of 60 miles, and now is at work on a second contract. It has also received the contract for the Chicago City Railway company for underground feeders. The Milwaukee Edison Illuminating company and the Pabst Power company of Milwaukee have a large quantity of Safety underground cables now in use. This company also furnished 100 miles of underground rubber-covered, lead-encased cables for the World's Columbian Exposition and upward of 30 miles of underground cables for the Buffalo General Electric company. It furnished all the cables for the Boston Common and all the Boston parks; also 40 miles of cables for Washington Park, Chicago.

A COMPLETE INSULATING PLANT.

General Manager Leonard F. Requa is known as one of the most tireless workers in the electrical field. Having an extensive mechanical knowledge, together with experience in the manufacture of wire, he has been able at all times to keep in pace with the demands made for various kinds of wire to suit all possible purchasers, who are willing to pay for first-class insulated wires and cables. From the appearance of every portion of the large factory, crowded as it is with work, it will evidently be but a short time before the company will have to move or extend its present facilities.

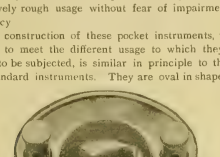
## American Institute of Electrical Engineers.

The next meeting of the Institute will be held at 12 West Thirty first street, New York city, on Wednesday, April 22d, at 8 P. M., at which time a paper will be read by D. McFarlan Moore of Newark, N. J., "On Recent Developments in Vacuum Tube Lighting," accompanied by experiments. The hall will be lighted by these tubes.

## Pocket Ammeters and Voltmeters.

The introduction by the General Electric company of the new Thomson measuring and testing instruments for alternating current work (described in the issue of March 28, 1896), has been followed by a development no less valuable, along similar lines; a set of ammeters and voltmeters has been especially designed for carriage in the side pocket of an ordinary coat. These instruments are known as the Thomson pocket ammeter and pocket voltmeter, and they give to the isolated plant engineer, the manager of the small central station and the working electrician a cheap and reliable instrument which may be carried in the pocket and exposed to comparatively rough usage without fear of impairment of accuracy

The construction of these pocket instruments, while suited to meet the different usage to which they are likely to be subjected, is similar in principle to that of the standard instruments. They are oval in shape, 4¾

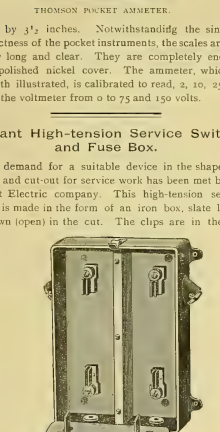


THOMSON POCKET AMMETER.

inches by 3½ inches. Notwithstandidg the singular compactness of the pocket instruments, the scales are unusually long and clear. They are completely encased by a polished nickel cover. The ammeter, which is herewith illustrated, is calibrated to read, 2, 10, 25 amperes; the voltmeter from 0 to 75 and 150 volts.

## Bryant High-tension Service Switch and Fuse Box.

The demand for a suitable device in the shape of a switch and cut-out for service work has been met by the Bryant Electric company. This high-tension service switch is made in the form of an iron box, slate lined, as shown (open) in the cut. The clips are in the box



BRYANT HIGH-TENSION SERVICE SWITCH AND FUSE BOX.

and the blades of the switch on the lid; the blades are about four or five inches apart, and a fuse is inserted between them. When the lid is opened the blades of the switch are dead, having no contact whatever with the live wires. The negative and positive sides of the switch are separated by a bridge of slate and the wires enter the box through porcelain bushings. The lid is hinged in such a manner that when closed it will remain closed owing to its own weight. It is also fastened by a spring clip. The handle is of wood and when the box is shut the parts carrying current are entirely protected. This device is extensively used as a service switch for 500 volt motor service, and has a capacity of 100 amperes. It is also admirably adapted for a service switch on 1,000 volt alternating or 220 volt direct current work. The Bryant Electric company's western office is in the Monadnock building, Chicago.

## Waring-Westinghouse Suit.

R. S. Waring, formerly actively connected with the Standard Underground Cable company, and the original owner of many of its valuable patents, recently entered suit against George Westinghouse, Jr., to recover the value of 10,000 shares of stock in the company. The well-known names of the litigants and the large amount involved make the case one of considerable interest, although the outcome cannot in any way affect the company itself or its policy, as the litigation is purely a personal matter between two of its stockholders as to an accounting.

Mr. Waring claimed that the stock in question was transferred by himself to Mr. Westinghouse at the time that Mr Westinghouse became connected with the company in March, 1889, and that the stock was to have been held in trust and for his benefit. In the course of the testimony many depositions were submitted from electrical experts and large users of underground cables, as to the high character of the Waring cable manufactured by this company. The depositions also showed that the cable made to-day is practically the same cable as was made in 1886.

The defense of Mr. Westinghouse to this suit was substantially that the stock in question had been given him outright, to secure his active interest and influence in favor of the company, which was then a new undertaking, and that there was no agreement or understanding that he held the stock for Mr. Waring, and that nothing was due to Mr. Waring on account thereof.

The case was brought to a sudden termination on the 9th inst., when the plaintiff withdrew his suit. The testimony on the main issue—viz., whether Mr. Westinghouse should account to Mr. Waring for the stock in question- seemed to be in favor of Mr. Westinghouse up to the time the suit was withdrawn.

## Electric Railroad on the Florida Keys.

Notice is given of the intended incorporation of the Tropical Electric company of Key West, Fla., by J. L. Watrous, J. M. Phipps and E. M. Martin, with a capital stock of $50,000, which may be increased to $5,000,000. The most interesting feature of the new venture is the general nature of the business to be transacted, which is set forth as follows in the notice of incorporation:

(1) The surveying, constructing, equipping, operating and maintaining an electric railroad in and from the city of Key West through the counties of Monroe and Dade by the most practicable route to a point on Biscayne Bay at or near the mouth of the Miami river, a distance of about 150 miles.

(2) The surveying, constructing, equipping, operating and maintaining a telegraph line in and from the city of Key West, through the counties of Monroe, Dade, Brevard, Osceola, Orange, Lake, Volusia, Marion, Putnam, St. Johns, Clay, Duval and Nassau to a point on the Florida and Georgia state line at or near White Oak, a distance of about 550 miles.

(3) The constructing, equipping, operating and maintaining an electric plant or plants in Key West and at other points along the line of its railroad and telegraph lines for the purpose of generating electricity for power, lighting or other purposes.

This prospectus certainly outlines a comprehensive and ambitious scheme, but it is very puzzling—especially the paragraph relating to the electric railroad. Key West is on an island having an area of 16 square miles and 60 miles from the nearest point on the mainland of Florida. Biscayne Bay is on the eastern coast of the mainland. What the "most practicable route" for an electric railroad between these two points would be is indeed difficult to determine.

## Threatened Strike in Chicago on Account of Employment of Non-Union Electrical Workers.

There is a possibility of a strike of the building trades on the Lewis Institute and the Great Northern Hotel building in Chicago. Complaint was made to the board of delegates of the Building Trades Council that the Western Electric company is employing non-union men to install the electric plant in the Lewis Institute. A committee was appointed to make an investigation. The trouble is said to grow out of a conflict between two organizations of electrical workers. The national organization is at war with the local unions, and an attempt is now being made to organize a rival local union. The men who are at the head of the movement are said to be employes of the Western Electric company and are at work on the Great Northern Hotel building and the Lewis Institute.

## Competition in Rockford.

[From the *Rockford Daily Register-Gazette* of March 17, 1896.]

The members of the City Council held one of the liveliest sessions of the winter Monday night, the sparring matches not being confined to the city fathers alone, for interested parties, who sat outside the railing had a few rounds. The fight was precipitated by the presentation by Alderman Dunn of the report of the committee on city lights, announcing that two bids were received for the construction of the pole line system, and the committee recommended that the offer of the Electrical Installation company of Chicago, to do the work for $20,-976, be accepted.

Mr. Adams, representing Adams, Green & Co. of Morrison, who also had a bid in which was $65 lower than the one the committee recommended, was given the floor and he threw a few bombs into the camp of the enemy. He said his bid was the lowest to do exactly the same work as the Installation company, as called for by the specifications, and he could not understand why the work should be given to the highest bidder. He pointed out what he termed some glaring errors in the bid of his opponent and offered to furnish a bond in any sum wished for the satisfactory performance of any promise made by him. Mr. Adams told about other plants which he had installed and, having the appearance of being a practical electrician, had many of the members of the council with him from the start.

Mr. Myers, who was there representing the Installation company, got excited over the prospect of losing the contract and attempted to answer Mr. Adams, although his remarks were of such a nature that every time he opened his mouth he lost a vote in the council. It had very much the appearance that he was trying to force the aldermen to give him the job, and they didn't like it. The representatives of the two construction companies sparred back and forth for half an hour and the mayor was finally forced to call Myers down, as he got abusive of his opponent.

Alderman Graham said he couldn't see why the committee should recommend the highest bid instead of the lowest.

Alderman Shepherd favored the highest bidder.

City Attorney Welsh, when questioned, stated that the statute contemplated that when bids were advertised for, the lowest should be accepted, if the party is a responsible one.

Alderman Graham moved to substiute the lowest bid, that of the Adams & Green company, for the committee report. The council was a tie and the mayor had to cast the deciding vote, which he did in favor of the lowest bidder, stating that he felt it his duty to do so under the statute. The aldermen who voted in favor of giving the contract to the highest bidder were Aldermen R. A. Shepherd, T. J. Derwent, Willis Kimball, A. E. Crowell, A. Hollem, Gust Holm and E. C. Dunn.

Those who voted in favor of the people and the lowest bidder were Aldermen Wm. Kopp, A. J. Anderson, G. V. Lindblade, Z. B. Sturtevant, F. S. Regan, J. Graham and J. Beatson.

Alderman Crowell, after the result was announced and Mr. Myers had made another speech, said he wanted to change his vote in favor of the lowest bidder.

On the adoption of the report, as amended, giving the work to the Adams & Green company, Aldermen Shepherd, Derwent and Dunn were the only persons to vote no.

Mayor Brown then explained how, through extensive correspondence, he had obtained a much cheaper figure on poles than the builders were able to get, which, with the striking out of the clause calling for the painting of the poles, would effect a saving of over $2,000 to the city. He predicted that the pole line system would be built for less than $20,000.

## Pacific Cable Delayed.

The rivalry between the two companies seeking a charter and a subsidy for the construction of a Pacific cable has resulted, for the time being at least, in the failure of either company to secure the prize.

The sub-committee of the Senate committee on foreign relations reported to the full committee a bill along the lines of that proposed by the Scrymser company of New York, but left the name blank so that the full committee could act thereon.

This bill was considered the best protection because for the same bonus larger advantages were offered to the government. The bill provided for a bonus of $160,000 a year for 20 years, in return for which the government was to have free use of the cable for public purposes in perpetuity. The rate to Hawaii was reduced to 35 cents a word and to Japan and China to $1.25 a word.

The Spaulding company proposed to build only to the Hawaiian Islands for the same bonus. When the proposition came up in the committee April 1st, the Spaulding advocates found ready allies in the four Democratic members of the committee, who were opposed to subsidies of any sort, and their votes were sufficient to defeat the proposition to report the Scrymser bill.

The opponents of the Spaulding measure were equally stubborn, and likewise voted with the Democrats to refuse to report the other measure. Between the committee factions in the Republican ranks the proposed cable fell through.

It is believed, however, that the committee will be able later to come to some conclusion that will lead to a satisfactory solution of the problem. Meanwhile, members of the committee suggest that the rival companies get together, if possible, and merge their interests. In that event the bill could be speedily reported to the Senate.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, April 11.—The project to run the trains of the New York and Brooklyn elevated roads across Brooklyn Bridge continues to excite attention. It is said to be feasible, and the plans are stated to be in readiness. The surface road companies would also like the privilege, and President Rossiter of the Brooklyn Heights company says that the proposition is practicable and could be put into effect without changing the present structure.

Prof. Pupin gave an address, illustrated by experiments, before the association of alumni of Columbia College at Sherry's this evening, his subject being the Röntgen radiance. The professor, in his talk, paid particular attention to the application of the discovery to surgery, and most of his stereopticon illustrations bore upon this point. One of the best of these was a picture of a human chest, made within the last few days, which distinctly showed the bones of the thorax and a stud on the shirt bosom of the subject, as well as the collar button on the back of the neck. The exposure of this photograph was greeted with hearty applause. Dr. Pupin expressed the belief that the rays would ultimately prove of inestimable value to surgeons and physicians in the practice of their profession.

A pathetic incident showing the extent of Tesla's fame is reported in the *Tribune*. One day last week the scientist received a call from Charles Broadway Rouss, who wished to see whether a severe shock of the electric current might benefit his eyesight, which has been steadily failing him for some time. In fact, his physicians have about given up all hope of restoring the organs of vision, and he seems doomed to pass the rest of his life in darkness. Mr. Tesla informed Mr. Rouss that he could do nothing to restore the sight, but that he would administer an electric shock with pleasure. He sent a current of 100,000 volts coursing through the nerves of the venerable merchant without visible effect. Mr. Rouss, however, afterward stated that before he permitted the shock he made the electrician take his hand, as he did not intend to die alone, if die he must from the contact. Dr. William F. Mittendorf, the attending physician, believes that there is no hope of preserving Mr. Rouss' eyesight to him much longer. "When a tree or a plant is dead," said the physician, "you cannot restore it by watering. So with the eye. When the nerve is dead nothing can bring it to life."

J. Elliott Smith, superintendent of the fire alarm telegraphs of New York, has been suspended, pending an investigation of his office.

The latest aspirant for recognition in the field of electrical periodical literature is *Electrical Doings*, a monthly journal published at 15 Cortlandt street in this city by John P. Madden. The new publication is started on the old-time assumption that the "popular" side of electrical development is neglected by the older journals in the electrical field, and it announces in its first issue that it will keep "fully in touch with the younger school of men who are just entering upon the practical study of electricity and need information, stripped of technical verbiage, in which our learned conlemporaries in the electrical field seem to revel." The management entertains the strange fallacy that in essaying this course it will serve a "hitherto much neglected constituency." The paper, which is curious but not unattractive in appearance, is evidently making a resolute effort to be "popular," as is shown by the fact that the principal illustration of its first issue is borrowed from the sensational *Journal* and by the remarkable statement in its leading editorial that "Electricity has become a force in nature."

W. F. O.

## Niagara Falls, N. Y.

NIAGARA FALLS, April 11.—Electricity is about to score another victory over steam, it being announced that the Niagara Central railroad, which runs between St. Catharines and Niagara Falls, Ont., is about to discard steam and adopt electricity as a motive power. This road is about 12 miles long, and it is understood that while operated by steam it has not been a profitable investment. With the use of electric power there is every prospect that the road will show good earnings.

Quite a large party of Cornell College students were at the Falls a few days ago to examine the big power plant, and while there they had an experience they are not likely to forget very soon. While at the machines they made a 500 volt short-circuit, with the result that the fuses were blown out with a loud explosion, and the wattmeter they had brought with them was badly wrecked. The young men were demoralized for a time, and their experiments in that line stopped suddenly.

The New York State Assembly has passed the bill confirming and defining certain riparian rights of the Niagara Falls Hydraulic Power & Manufacturing company, whereby the company's enlargement of its hydraulic canal is legalized and by which 100,000 horse power may be developed.

The New York State Legislature is once more considering a bill intended to confer upon Alonzo C. Mather of Chicago the right to build an experimental bridge in the Niagara river near Buffalo for the purpose of developing power from the current of the river. There is much opposition to the measure and it is not likely to become a law.

It has been suggested that as Niagara Falls is so great a source of power for electrical distribution, there ought to be a permanent and prominent advertisement of that fact within the range of the eyes of every person that approaches the city by sight and visible to all of the surrounding communities. This might be a powerful searchlight or a big electrical arch. It is thought either of the power companies would be willing to furnish the current needed if public-spirited citizens would furnish the apparatus.

During the month of April the Niagara Falls & Lewiston railway, the electric road which runs between Niagara Falls and Lewiston through the Niagara gorge, will not be operated. This decision was reached on the return of President Brinker from a western trip. While the road is idle the roadbed and rolling stock will be put in first-class shape in readiness for the expected heavy travel of the coming summer. When reopened the road will be operated over its entire length for the first time.

For some time negotiations have been going on for the purchase of an electric railway franchise on the Niagara Peninsula. It is announced that a syndicate is now being formed. It is said to be the intention of the syndicate to extend the line so as to make it a through line from Toronto to Niagara Falls, Ont., with all necessary equipment. The syndicate is made up of prominent capitalists from Toronto, Montreal, New York, and elsewhere. O. E. D.

## Washington, D. C.

WASHINGTON, April 10.—Representative H. W. Rusk of Maryland has introduced a bill in Congress to incorporate the Columbia Subway company. The capital stock of the company will be $500,000, and it will have authority to own and control in the public streets, avenues, roads and alleys a subway and conduit for the use of all incorporated companies, telegraph companies, telephone companies, electric light companies and all other companies that are required to use wires in connection with their business. The subways are to be built under the direction and supervision of the District commissioners, and all wires on or over the streets, avenues and alleys, when such a subway is laid, must be removed or placed in the conduit or subway within 30 days after the completion of the subway under the penalty of $10 a day for each wire and every pole carrying an overhead wire that remains on road, street, avenue or alley. The shares of the company will be $50 each, and those interested in the corporation are T. Barton Jones, G. C. Schuermann and John Henry Keen of Baltimore, and A. W. Fletcher, H. C. Lybrand, H. J. Finley and Charles Eisenstein of Washington, D. C. The bill has been referred to the committee on the District of Columbia.

The bill to amend an act to authorize the Interoceanic Railway company to construct and operate railway, telegraph and telephone lines through the Indian Territory has passed the House, and has been introduced in the Senate by Senator Jones of Arkansas. The chief amendment makes the city of Fort Smith the terminus of the road on the western border of the state of Arkansas.

Senator Butler of North Carolina has introduced a bill in the Senate to establish a postal telegraph system and to enlarge the postal facilities of the people of the United States. The bill has been laid on the table.

The committee on appropriations has reported the sundry civil appropriations to the House. A number of radical changes are recommended which touch upon matters of interest. One of the important provisions of the bill provides that Lafayette, Franklin and Judiciary parks are in future to be lighted by electricity, as also the grounds of the capitol building. An appropriation of $16,000 has been made for lighting the capitol, including the Botanic Garden, Maltby building, etc.; the estimates were $26,000. For lighting the capitol grounds by electric light, for 50 posts in the public grounds at 28 cents per light per night, operated entirely by means of underground wires, $5,110 has been appropriated.

The Fainton Electrical Steamship & Construction company was granted a charter at Alexandria, Va., this week. The capital stock is $1,000,000. The object of the company is to build ships to be propelled by electricity or steam, in conformity with certain patents. The officers are all from Williamsport, Pa., and are as follows: President, R. B. Fainton; vice-president, J. W. Bailey; secretary, H. A. Solomon; treasurer, Hiram Warren.

An application has been made in the United States Circuit Court in Baltimore by E. D. Smith & Son, one of the controlling firms engaged in building what is known as the Boulevard electric road between Washington and Baltimore, for a receiver for the Baltimore & Catonsville Construction company and the Columbia & Maryland Railway company. The petitioners say they were awarded the contract for constructing and equipping the road, which they were to have completed by March 2, 1896. One-half of the payment was to be in cash and one-half in the bonds of the Columbia & Maryland Railway company at the rate of 90 cents on the dollar, which bonds were to be a first lien on the property of the company. The firm did four months' work on the road at a cost of $140,895, for labor and material furnished. Smith & Son allege that neither the Construction company, the Columbia & Maryland company, the Edmondson Avenue, Catonsville & Ellicott City Electric Railway company, nor the Maryland & Washington Railway company, all constituent companies, has charter powers, nor do they collectively have charter powers to build a line of road, and for that reason the road could not be validly mortgaged. The firm say they are creditors of the Construction company to the amount of $70,447.80 on account of work and materials. Work on the road was stopped at Hyattsville this week because of an injunction taken by the Holliday Land company, which claims the railroad is unlawfully occupying land belonging to the Land company. T. M.

## Northwestern Notations.

MINNEAPOLIS, April 10.—A new 1,000 light dynamo has been put in the electric light plant at Aberdeen, S. D., and substantial repairs will be made to the building and equipment this summer.

T. Von Rolf secured the contract for an electric light plant for Decorah, Ia.

Mr. Probst says the electric light project for Bathgate, N. D., is assured and that work will be begun in the early spring. About 200 lights have been contracted for now, and it is expected that 300 will be by the time the plant is completed.

That familiar theme, a second interurban electric line between Minneapolis and St. Paul, has made its spring appearance. It is projected via Como Park, Langford avenue, St. Anthony Park, and into Minneapolis, connecting with the Como avenue line.

The crop of personal injury suits against the street car company in Minneapolis has materially decreased at the present term of court, owing, it is thought, to the use of the safety gates on the cars. The new fenders have at last had a practical trial and worked splendidly. A four-year-old child started across the tracks just at dusk, and was not seen by the motorman of the car until she was just in front of the car. The fender picked her up, unharmed, save for a slight cut on the head.

Harold Tenney, of Faribault, Minn., has invented an electric alarm clock and applied for a patent. It is designed for use in hotels and other places where a number of calls at different times must be made promptly. An ordinary clock is used, with a supplementary copper rim, sawed into 48 sections, representing quarter hours, to which wires are attached; these wires run to a switchboard having corresponding sections, properly numbered. One pole of the battery is connected to the switchboard and the other to the clock-work. The hour hand has an extra copper finger that slips over the brass rim, and when it arrives at the section corresponding to the one plugged in the board, a circuit is closed and a bell rings for 15 minutes unless the plug is drawn. As many calls as there are sections can be set.

A bill placing street railways under control of the railroad commissioners has been pending in the Iowa Legislature, but was defeated.

Attorney-general Remley of Iowa has handed down an opinion in the matter of taxing the Cedar Rapids & Marion City railroad, to the effect that it cannot be taxed as a railroad, holding that street railways are ex-

empt It is hinted that street railways would not have been averse to a decision taxing them as railroads, because that would have relieved them from having to pave their tracks.

In the suit for damages against the St. Paul Gas Light company, by T. Kinnen, for the death of his son from grasping uninsulated wires on the top of a building, Judge Kelly held that the boy had no business there, and the company was not liable. He added, however, that the plaintiff deserved the thanks of the community for bringing the suit, that the attention of lawmakers might be brought to the wires, which should be guarded as far as possible

The councils of Oshkosh, Wis., and St. Paul, Minn., are considering ordinances for wire inspection. The former will impose a daily penalty of $5 on owners of buildings who do not make changes in wiring ordered by the inspector. In St. Paul the charter forbids creating any new office, and the work will be put in charge of the building inspector, and he has not sufficient funds to hire an assistant to do the work and will have to add the work to that of his department.

People of Lakeside, a suburb of Duluth, want better service on their car line, but the management says it can better afford to abandon the line than to increase the service.

It is reported that an electric car line will be put in at Eldora, Ia., by the electric light company.

It is reported that the Postal Telegraph company will extend its system from Freeport, Ill., to Madison, Wis., and have the line completed by June 1st.

Work will be begun early this spring on the electric light plant at Dyersville, Ia.

The Luverne, Minn., city council has paid up all warrants drawn for the electric light plant, and it now stands free from debt. The plant was put in in 1892, and cost $8,000. Improvements costing $5,000 more have been made, making the total cost $13,000.

The Electrical Engineering company of Minneapolis secured the contract for an electric light plant at West Union, Ia.

The Western Electric company of Chicago secured the contract for a lighting plant for the state school for the blind at Janesville, Wis., for $1,240.

The matter of an electric light plant is being considered at Waukon, Ia., and McGregor, Ia. Residents have applied for a franchise.

The council of Mankato, Minn., has voted to reject all bids for establishing an electric light and street railway system. This includes the bid of L. E. Walkins of Boston, whose bid was informally accepted by wire, but who failed to come to Mankato to close the contract. The council voted to take new bids, but the Mankato Gas & Electric Light company made a favorable offer of arc lights for $75 per year, on a five-year contract, and the vexatious question may be settled finally by accepting the offer.

Business men of Olivia, Minn., think they want an electric light plant, provided the expense can be borne without excessive taxation.

An electric light plant will be put in at Sanborn, Ia. Prairie City, Ia., will have electric lights.

A mass meeting at Winnebago City, Minn., requested the council to take bids for an electric light plant to ascertain whether it would be better to bond the town for a plant or grant a franchise.

The contract to put in an electric light plant at Le Sueur, Minn., was let to O. H. Olson & Co. of Stillwater, Minn.

D. J. Tew and N. P. Colburn have been granted a franchise for electric lights at Rushford, Minn.

Receiver Clark took possession of the Cloud, Minn., street car line April 1st. C.

## PERSONAL.

Charles D. Shain of New York was a Chicago visitor this week.

The many friends of William S. Beatty, of the Pittsburg office of the General Electric company will be pained to learn of his death on April 7th in New Orleans. Mr. Beatty was obliged to give up his work some weeks before on account of failing health and to seek a more congenial climate in Florida, and later in Arizona. Finding no improvement, however, he was on his way home, but on reaching New Orleans was unable to proceed farther. Mr. Beatty was a comparatively young man for the position he filled and had marked abilities which gave promise of a brilliant future. His agreeable and obliging manners made him friends everywhere, and his sudden death comes as a great shock to them all.

## ELECTRIC LIGHTING.

The Hotel Metropole of Chicago will soon be equipped with its own electric lighting plant at an expense of about $20,000

The city of Keokuk, Ia., has propositions for a renewal of its electric lighting contract, and is also considering the advisability of building its own plant. Frank M. Fuller is the chairman of the light committee of the Keokuk city council

## ELECTRIC RAILWAYS.

The City Electric Railway company of Decatur, Ill., has recently established a handsome transfer house near the center of the city, where line connections are made. The house is octagonal in shape and cost about $3,000.

In the reference recently made in this journal to the experiments in Cleveland in relation to storage battery traction, it should have been stated that Mr. Washburn, the inventor of the battery and motor, is connected with the Ohio Storage Battery company, not with the old Ford-Washburn Storelectro company.

## MISCELLANEOUS.

The convenience of the metric system is well illustrated by the movement now on foot between the makers and users of screws throughout the world, to have the threads adjusted to a common metric measure.

On Friday evening, April 17th, Thomas G. Grier will read a paper before the Chicago Electrical association on "Little Economies in Central Station Practice." The meeting will be held at room 1737 Monadnock building.

The National Association of Manufacturers of the United States has issued a circular advocating the establishment by the government of a department of commerce and manufactures, to be in charge of a member of the president's cabinet. It is argued that to concentrate in one new department the various scattered bureaus which are more or less commercial or industrial in character would enormously increase the efficiency of their service without necessarily involving any large increase in the expenses of the government. This circular will be furnished to applicants by President Search from headquarters, No. 1748 North Fourth street, Philadelphia, Pa., or by E. P. Wilson, secretary, room A Chamber of Commerce, Cincinnati, Ohio.

## TRADE NEWS.

On April 10th the New York offices of the Excelsior Electric company were removed to the Boreel building, 115 Broadway, from 44 Broad street.

The Central Electric company has secured the western agency for the entire product of the Massachusetts Chemical company. Two of the best known articles manufactured by the Massachusetts company are "Insulac" and "Armalac," which have heretofore been sold by the Central company and have demonstrated their popularity by extensive sales.

The G. & H. Barnett company announces the election at the annual stockholders' meeting of the following named officers to succeed those made necessary by the decease of our late president, George Barnett: President, Henry Barnett; vice-president, Henry W. Scattergood; secretary and treasurer, Alfred W. Barnett; directors, Henry Barnett, Henry W. Scattergood, Alfred W. Barnett, Wm. Barnett, Henry L. Cosling.

The operation of shoe factories by electricity seems to be making steady headway. The General Electric company is about to undertake the electrical equipment of the Norway Shoe Shop company of Norway, Me. Seven non-synchronous multiphase motors, aggregating 100 horse power, will be put in. The current will be taken from the 250 kilowatt three-phase generator recently set up in its station by the Norway Electric Light company.

Charles Wirt, 1028 Filbert street, Philadelphia, has enlarged quarters and increased facilities for the manufacture of the Wirt dynamo brush. Mr. Wirt reports that he has been making radical changes in methods of manufacture, as the old methods were too slow to keep pace with increasing business and too expensive to meet competition. The Wirt brush of to-day is being modified to suit different classes of machines, as it has been proved that the best combination of material for one case is not the best for every case.

I. B. Willams & Sons of Dover, N. H., know how to issue very attractive advertising material and also how to make the best kind of dynamo belting. They are distributing a beautiful picture of a child's head, life size, in colors, ready for hanging up, with a modest card at the bottom, which will prove an ornament to any office wall. They also send a booklet on "Dynamo Belting," which is chock-full of meaty information. The fact that they use only "centers" for their belting, for both sides, with no rivets, "nothing but leather and cement," is impressed on the reader very forcibly.

C. J. Sturgeon has resigned as manager of the Keystone Electrical company of Erie, Pa., to connect himself with the Smith-Hill Elevator company of Quincy, Ill. Mr. Sturgeon was one of the original founders of the Keystone company and has, by his indefatigable energy and thorough-going business ability, contributed very largely to making it the large and thriving concern it now is. Mr. Sturgeon was one of the pioneers in electric elevator work, having designed and installed a very large proportion of all the plants of this character in the country. In devoting his wide experience in this line to the Smith-Hill Elevator company, large and increasing business is assured to that corporation.

The Orient Electric company of Youngstown, O., has established a western office at No. 642 Monadnock building, Chicago, in charge of Thad S. Lane. This company was reorganized in December and at that time its factory and equipment were thoroughly overhauled and important additions and improvements made in machinery and methods of manufacturing. The company is placing on the market a high grade incandescent lamp. Special attention is given the testing of lamps, each being subjected to three tests on different instruments made especially for the purpose, so that the company is sure that its entire output comprises the very best quality of lamps. The shop is in charge of C. N. Sadler, who is known as one of the best practical lamp makers in the country, and the laboratory is in the hands of capable men. The Chicago representative, Mr. Lane, is a salesman of experience and is widely known in central stations and among the trade in general. He will carry a complete stock of lamps at Chicago, thus insuring prompt filling of orders in his territory. Special effort will be made to secure western business. Every facility has been placed at Mr. Lane's disposal for satisfactorily filling orders. The company claims that while its lamps are not the lowest in price they are the cheapest lamps obtainable considering the ratio of light to the current consumed. They are of high efficiency and are highly recommended by central station men who have had experience with them

## BUSINESS.

The Ohio Electric Works of 13 South Water street, Cleveland, make an attractive line of electrical novelties, including the popular electric light scarfpin. Liberal terms are made to agents.

The Garton lightning arresters made by the Garton-Daniels Electric company of Keokuk, Iowa, are steadily increasing in favor. They are said to "last forever," and to be unequaled for durability, reliability and efficiency. They are made for use on any circuit, either direct or alternating current

The neat little catalogue of the Missouri Telephone Manufacturing company of St. Louis shows that the company makes about any kind of telephone desired. The Kusel transmitter, said to be the simplest battery carbon transmitter in the world, is usually used, but the Blake or Hunnings types can be furnished if desired. The catalogue contains valuable information of a general nature, and will be sent on request.

As summer approaches the fan motor business awakes from a winter's slumber. The Electric Appliance company already has quite a large stock of Meston alternating current fan motors and is ready for business with this specialty. Anticipation of requirements is always a good policy in placing orders for seasonable goods of this kind, and the Electric Appliance company suggests that orders be placed as early as possible for the season's demands

The Metropolitan Electric company has taken the exclusive western agency for the Gordon primary battery, which is manufactured by the Gordon-Burnham Battery company of New York. It carries a large stock of these batteries. This battery is claimed to be the latest improvement in primary battery work and that for which it is found to give excellent service for railway signal devices, fire alarm telegraph circuits and other exposed points that require constant battery with a minimum of attention.

On April 10th the offices and warehouse of the Standard Paint company were removed to 81 and 83 John street, New York, to which address all communications should be forwarded hereafter. At the new place of business will also be found the headquarters for the sale of the "Ship" carbons, manufactured by Schiff, Jordan & Co., Vienna, for which firm this company has established a department of its business and is its sole representative in the United States and Canada. All communications for this department should be addressed "carbon department," and all letters relating to the company's foreign business should be marked "foreign department."

The use of electricity in textile industries is rapidly widening, as its adoption is found to give to textile machinery the perfect regulation so essential to high grade production. One of the most recent installations has been made in the mills of W. J. Dickey & Son Baltimore, Md., by the General Electric company. The electricity is generated by two 90 horse power moderate-speed generators, belted to a horizontal water wheel. The current is transmitted about 200 feet to the third story of a woolen mill, where it will be used to operate motors and furnish light. In this third story 36 sixty-inch woolen cards and four mules are to be placed, the cards being arranged in three rows, 13 to a row, with a line of shafting to operate each row. The motors will be placed either on top of the roof beams or suspended from the beams by iron slings, and will be connected to the line shaft by a belt. Two of these line shafts will be operated by two 25 horse power slow-speed motors. For the operation of the mules a 20 horse power, moderate-speed motor will be connected to the shafting

Western and southwestern buyers of high-class electrical supplies, as well as a large eastern connection will be interested to learn that on April 15th The Commercial Electrical Supply company of St. Louis doubled its capital stock. The company's remarkable growth in

business during the last year necessitated the increased capital, and this step in itself may be taken as a substantial compliment to the concern's aggressive management. Since the reorganization of the Commercial company under the control of President Joseph Franklin, Jr., its energetic yet conservative and fair business policy has brought the house into a leading and enviable position with the trade in its large territory; in fact, it is an open secret that the personnel of the company has had a very substantial effect in the rapid advancement of the concern's influence throughout the West. With a thoroughly experienced staff of traveling men, Mr. Franklin has managed to make the Commercial company "felt" in a way that necessitates carrying in his large St. Louis salesrooms and warehouse a most varied and extensive stock. The increase in capital will add to the already large resources, and it places the company in a position second to none in its territory.

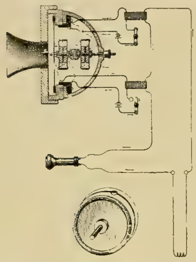
# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued April 7, 1896.*

557,534. Pressure Alarm for Gas Pipes. Francis S. Baker, Chicago, Ill. Application filed January 17, 1895.

The combination with a furnace or gas-burning device and its gas supply pipe, of an electric circuit, an alarm device included in the circuit, an annunciator drop included in the circuit, a bent tube containing mercury or other electric conducting liquid, communicating at one end with the gas supply pipe, and the free end of the bent tube having a small aperture to steady the movement of the mercury under fluctuations of pressure in the gas supply pipe, and electric terminals or contact pieces connected with the circuit, and between which the circuit is closed by the mercury in the bent tube when acted upon by a change of pressure in the gas supply pipe.

557,535. Electric Car Truck. Charles F. Baker, Boston, Mass. Application filed September 16, 1895.



NO. 557,588.

In a four-wheel truck, the combination of the following instrumentalities is claimed: A truck frame having each of its sides composed of two sets of bars separated to leave a longitudinally extended space, housings for the car axles extended up into the space near the opposite ends of the truck frame and firmly secured to the side bars, spring seats inserted into the space intermediate of the housings, springs supported by the seats, and a transversely extended pivoted truck bolster having its ends supported upon the springs above the side bars of the truck frame.

557,588. Telephony. William C. Lockwood and John M. Lockwood, Brooklyn, N. Y. Application filed October 29, 1894.

A variable resistance for a telephone transmitter, consisting of two disconnected flat electrodes located between suitable flat flexible plates in a suitable shell, and a filling of loose conductive material packed in the shell around the electrodes.

557,600. Insulator. Cyrus A. Peterson, Stratton, Neb. Application filed November 11, 1891.

This insulator has a screw-threaded perforation and a metal rod pointed at one end, a spiral coil of wire secured to the opposite end of the rod and retained in engagement with the screw-threaded insulator.

557,606. Electric Arc Lamp. Theodore Reyman, New York, N. Y. Application filed July 9, 1895.

Features of the invention are: The vertical tube secured within the casing and screwed thereto, the tubular extension upon the top of the casing and connected with an opening in the casing within the tubular extension, the tube being provided with a cap or covering in which is formed an opening, the cap or covering having a hinge lid to close the opening, the piston within the tube carrying a rack-bar, upon the lower end of which is secured the upper carbon, and the frame pivoted at one end to a vertical standard at one side of the casing, a transverse shaft connected with the frame, upon which is mounted a pinion gearing with the rack bar, the horizontal bar having pivotal connections with the top of the casing, and provided at each end with a depending armature extending into the magnets, pivotal connections with the free end of the frame, whereby the piston regulates the downward movement of the rack-bar.

557,648. Electric Arc Lamp. Harold E. Bradley, Pawtucket, R. I. Application filed February 6, 1896.

A star-wheel forming part of a system of wheel gearing is actuated by the weight of the upper carbon rod, in combination with a pendulum, and a stop limiting the motion of the pendulum, which engages the star-wheel and holds it fast when the lamp is not feeding, and acts as a retarding device when the lamp is feeding.

557,650. Electric Indicator for Hot Journal Boxes. William B. Chockley, Denver, Colo. Application filed March 15, 1895.

An electric alarm is connected with a glass tube arranged and adapted to hold a heat-expanding conductive fluid, preferably mercury, a cap sealed to the top of the tube, a contact terminal adjustable longitudinally in the cap, a central [illegible] in the end of the contact terminal, a slot through the [illegible] piece into the perforation, and a binding screw threaded in the cap to extend through the slot into the perforation.

557,657. Electric Railroad. William R. Elliott, Chicago, Ill. Application filed June 27, 1895.

A magnet [illegible] to be used on an electric car for actuating a contact [illegible] device consists of a straight central portion having [illegible] curved ends on a lower plane than the central portion.

557,67[illegible]. Commutator Brush Holder. Robert Hirsch, Milwaukee, Wis. Application filed July 1, 1895.

The brush holder [illegible] comprises a suitable support, having a plane surface in line with the desired position of the brush a spring-controlled arm or plate pivoted at one end to the support, and a second spring-controlled arm pivotally connected at one end with the free end of the first mentioned arm or plate, and adapted to bear at its free end against the rear end of the brush, so as to press the latter into electrical contact with the surface of the support, and to press its forward end into electrical contact with an adjacent commutator.

557,708. Testing Apparatus for Multiple Switchboards. Charles E. Scribner, Chicago, Ill. Application filed June 19, 1888.

One claim is for the combination with several telephone lines connected with multiple switchboards, each being provided with an individual annunciator, of a coil of a different converter included in each line between the switch of the line on the last board and its individual annunciator, the different converters being energized by pulsatory or undulatory currents sent through the circuit of their primaries, and means for automatically opening the portion of the circuit of the line which includes the converter when a connection is made therewith at any of the switchboards.

557,714. Electric Motor. Imle E. Storey, Hornellsville, N. Y. Application filed January 28, 1893.

An inclosing shell provided with an opening, a disk or plate of insulating material fitting into the opening and supporting a brush holder, and a removable cap adapted to cover the opening.

557,741. Telephone Transmitter. Walter L. Wilhelm, Buffalo, N. Y. Application filed November 21, 1895.

The mouthpiece is provided with two branch tubes; two supporting disks are secured to the tubes and separated from each other so as to form an open-sided space between the disks, and a transmitting device is arranged in the space.

557,749. Automatic Electric Railway Signal. William W. Alexander, Kansas City, Mo. Application filed December 10, 1889.

A power train of wheels operating simultaneously a semaphore, and a message-transmitting device, a set of trigger levers, an electro-magnet controlling the levers, and an escapement device for retarding the power train are employed.

557,777. Electric Switch. Abraham K. Dresher, Worcester, Pa. Application filed April 24, 1895.

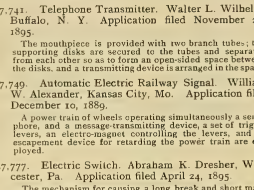
The mechanism for causing a long break and short make is formed of a long and short spring and wedge cams.

557,784. Closed Conduit and Appliance for Electric Railroads. William R. Edelen, Washington, D. C. Application filed November 16, 1895.

A closed conduit for electric and other railways, having a series of covers, each normally locked in a closed position, and adapted to be released or unlocked by the movement of a preceding cover is described.

557,809. Electrically Operated Agricultural Machine. Israel Hogeland, Chicago, Ill. Application filed November 22, 1895.

One claim is given: In a field, the combination of a main conductor, one or more branch conductors leading from the main conductor, a dynamo-electric machine connected with said main conductor, an engine for driving the dynamo, and a locomotive agricultural machine carrying an electric motor connected with the running gear of the machine to propel it, and connected with one of said branch conductors, a ground wire anchored at opposite ends and passing between its ends over a guide pulley on an axle of the machine, and a take-up and pay-out mechanism for the branch conductor.



NO. 557,708.

557,816. Electro-plating Copper. William B. Hollingshead, Bronxville, N. Y. Application filed September 23, 1889.

The bath for copper electro-plating is composed of twelve parts of ammonium cyanid, sixty-one parts of potassium tartrate (neutral), twenty-seven parts of a mixture of water and oxid of copper mixed to a paste, and water.

557,819. Winding Device for Electric Cables in Elevators. David E. Houser, Fort Wayne, Ind. Application filed August 16, 1895.

A cable-winding device for elevators is described, comprising a winding drum for the cable, having a fixed shaft revolubly mounted in proper bearings on a supporting casting, and provided with a series of contact rings, a pinion rigid upon one extremity of the shaft, a gear-wheel mounted in the casting and meshing with the pinion, a driving spring arranged and adapted to actuate the wheel and drum, and a series of brushes fixed upon an insulated base and adapted for a frictional contact with the rings respectively.

557,830. Conduit for Electrical Conductors. John M. Kinney, Boston, Mass. Application filed August 6, 1895.

A conduit for electrical conductors is formed of a series of layers of paper first saturated with alum and coated with a mixture of bichromate of potash, glue and diatomite.

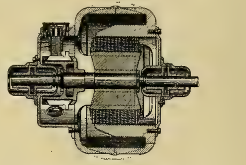
557,848. Electric Switch. Paul E. Marchand, Ottawa, Canada. Application filed November 2, 1895.

One or more stationary contacts, an oscillating contact, a stem or handle having a rotary and endwise movement, means for detachably connecting the stem or handle to the oscillating contact, a spring for moving the oscillating contact in a direction reverse to that imparted by the handle or stem, and a spring or springs for normally holding the oscillating contact in its adjusted position.

557,854. Automatic Battery Reverser. Paul Minnis, Mobile, Ala. Application filed February 17, 1896.

A balanced armature having conducting ends is provided, together with electro-magnets arranged beneath the ends, independent circuits for the magnets, and a tube of insulating material, such as glass, mounted on the armature and containing a globule of mercury.

557,860. Hanger for Trolley Wires. William A. McCallum, Avondale, Ohio. Application filed June 24, 1895.



NO. 557,714.

One claim is given. In an electric wire hanger, the combination of the cap, having interior projections, and the sleeve carrying an insulated suspensory bolt, and having projections for enabling the entering devices when the sleeve is rotated to interlock with the cap and the locking pin.

557,869. Armature Core. Granville F. Packard, Fort Wayne, Ind. Application filed December 26, 1895.

A sheet-iron lamina or punching for an armature core, consisting of a segment of the core having upon its inner side apertured ears for the fastening bolts, the ears having their annular portions slitted for the purpose specified and united to the body of the punching by a contracted neck to isolate the bolt from the magnetic flux of the core.

557,881. Insulator. Hannibal W. Rappleye, Philadelphia, Pa. Application filed February 24, 1896.

An insulator is described, having grooves, in one of which the wire to be clamped is adapted to rest, a clamp adapted to secure the wire in position, a lever adapted to act on the clamp, and a supporting device for the clamp and lever to which the lever is pivotally attached, the supporting device resting in the other groove, and being of such size that it is movable around the insulator.

557,888. Shade for Electric Lights. Willis E. Robinson, Faribault, Minn. Application filed June 20, 1895.

This is a shield for electric or other lights, comprising a shading leaf, a holder attached to the leaf provided with a head containing a spring, and a clamp having a loop passed through the head and in constant contact with the spring therein.

557,898. Lock-out System for Telephone Lines. Charles E. Scribner, Chicago, Ill. Application filed July 22, 1895.

The inventor claims the combination with a telephone line, of a telephone at a sub-station thereof, a relay having switch contacts adapted to complete a connection of the telephone to permit the use thereof, a device adapted to prevent the completion of the circuit through the telephone, and a magnet controlling the device, and means for exciting the relay magnet alone, or the last-mentioned magnet and the relay magnet successively, whereby the use of the telephone may be permitted or prevented.

557,920. Storage Battery. Alexander F. Vetter, New York, N. Y. Application filed August 30, 1895.

A battery plate formed of a section of lead pipe or tube closed at one end, and cut away at the other end to form a conductor provided with a filling of active material closed together at the top and flattened, and furnished with perforations.

557,957. Rotary Field Motor. Charles S. Bradley, Avon, N. Y. Application filed September 30, 1895.

The method of regulating an alternating current motor consisting in increasing the capacity inductance product of its secondary circuit or circuits as the speed increases, and vice versa, is described.

558,016. Electric Rail Bond. Bruce Ford and William Jens, Johnstown, Pa. Application filed July 22, 1895.

A rail having integrally attached thereto a flexible extension, having at its free end a head for attachment to an adjacent rail.

REISSUE.

11,529. Multiple Switchboard for Telephone Exchanges. Milo G. Kellogg, Chicago, Ill. Application filed July 22, 1890. Serial number 359,569, dated July 31, 1888.

The first claim: In a telephone exchange system, a metallic circuit subscriber's line normally disconnected from the ground at the subscriber's station, in combination with a calling generator in the circuit of the line at the subscriber's station, and a switch co-operating with the normally open ground to close the same while the generator is being operated.

# Western Electrician.

**EVERY SATURDAY.**

Vol. XVIII. CHICAGO, APRIL 25, 1896. No. 17

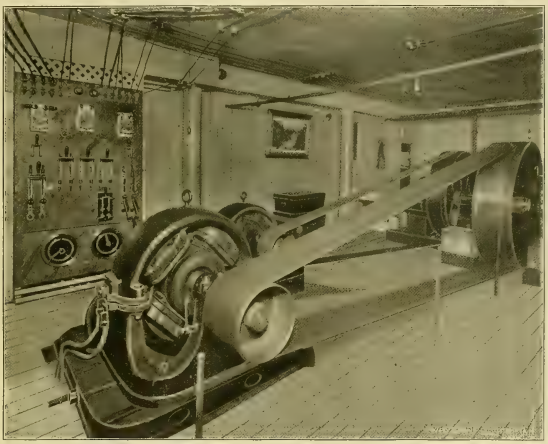

## Revere House Transformation.

The new Revere House plant, herewith illustrated, furnishes a striking instance of the economy of using modern apparatus, under expert engineering advice, as a substitute for antiquated machinery and methods. This hotel has about 200 guest rooms and stands at the corner of North Clark and Michigan streets, Chicago, where it has been a North Side landmark for many years. It recently came under the control of J. J. Philbin, an energetic young man, who remodeled the entire property to conform to present-day ideas of convenience and utility. Mr. Philbin considered a modern heating, lighting and power plant of the first importance in the transformation, and he placed this improvement in charge of Charles G. Armstrong, the well-known electrical engineer, with very satisfactory results.

The hotel had been lighted by gas and heated by steam furnished by three boilers, which also supplied an engine running the laundry machinery. The expense for fuel and gas averaged about $400 per month. With a modern steam and electric lighting plant, using the exhaust from the engines for heating, an average monthly saving of $225 per month is effected—certainly a very plain demonstration of the truth that the employment of a skilled engineer is a good investment for the client.

The old boiler plant was retained, but with such improvements as were found necessary to procure perfect combustion. Feed-water heaters, condensers and automatic pressure valves were added to insure the greatest possible economy in the use of steam. Two Phœnix high-speed simple engines of 35 and 75 horse power, respectively, were installed to drive the two dynamos for supplying the needed light and power. Westinghouse multipolar machines are used for this purpose, directly belted to the engines, as shown in the picture. The dynamo units are of 22½ and 45 kilowatts capacity, respectively, and two lighting sets are provided as a factor of safety. The exhaust steam is used for heating. The dynamos are compound-wound and can be run singly or in multiple. The switchboard is of dark-colored marble, attractively fitted with the usual accessories. The building is wired for about 1,000 incandescent and four arc lights, and a five horse power motor furnishes power for the laundry. The lobby, offices, parlors, billiard-room and bar are decoratively illuminated by incandescent lamps set about the ceiling and in ornamental plaster work; the other lights necessary are supported on fixtures.

This compact and attractive plant was installed by Gustave Monrath & Co. of Chicago.



REVERE HOUSE TRANSFORMATION.—ELECTRIC LIGHTING PLANT

## Influence of Atmospheric Electricity on Humanity.

Among the conditions in India which predispose to sunstroke a peculiar condition of the air is noticed, when the hairs of the horses' tails are mutually repellant, when one's own hair refuses to remain in proper condition; the individual is irritable, has headache, and is worried without apparent cause.

Various investigators have remarked that a storm is often preceded by such indications; but it has been a matter of uncertainty whether such phenomena are due to atmospheric electricity or to some general conditions of the ambient air.

Whatever the cause may be which creates the electrical disturbance before a storm, this induces an opposite condition upon the earth in all cases; or, in other words, the potential difference between air and earth is aggravated. Man standing upon the earth under these conditions becomes to an extent a discharging rod reaching toward the opposite polarity, like a tree or a lightning-rod, and so assists in a quiet discharge tending toward equilibrium.

The difference of potential between the head and feet of an individual so placed may be subject to quite extreme fluctuations of current flow. Lord Kelvin found in some experiments made at an island on the coast of Scotland that a difference of potential existed between the earth and a burning match, carefully insulated at 2.7 meters high, varying between 300 and 400 volts. With a breeze blowing from the east or the northeast this difference of potential sometimes rose to from 3,000 to 4,000 volts.

It is claimed that these variations, which are so in excess of the normal, are due to masses of positively electrified air hundreds of meters above us, moving at a rate of 1 5 to 5 meters per second.

These experiments also show that between seasons of calm and storm there are marked differences in potentials. During a thunder-storm sudden and violent changes occur. They may be sufficiently powerful to affect the human organism quite seriously.

The body is then constantly in a species of electric bath, the conditions of which are liable at any instant to change, reverse, discontinue or be renewed, and to be subject to varying voltages as well. It is proverbial, especially in that portion of the globe, to attribute all sorts of ill to the terrible east winds. The experiments of Lord Kelvin, of D'Arsonval, of Tesla and that class of philosophers are doing much to explain many of the mysteries which pertain to physiology, and must eventually work very radical changes in present methods of disease treatment

## Diffusion and Opalescence[1] with Röntgen Rays.

By Elihu Thomson

So far as the writer is aware the phenomena presently to be described have not hitherto been alluded to by writers or experimenters on Röntgen rays. They are the phenomena of diffusion of such rays by certain classes of substances in such a way that such substances must come to be regarded as opalescent or to act like opal glass in ordinary light or like milky liquids, a diffusion of incident rays taking place from the interior and exterior of the mass

Some substances are found to behave with Röntgen rays in the way that compacted snow or translucent ice act in diffusing light.

Let a fairly large metal screen, such as a brass or iron plate of $\frac{1}{8}$ to $\frac{1}{4}$ inch in thickness, be suspended in a vertical plane about a foot or more from a Crookes tube kept in action and emitting rays toward the plate. On the side of the plate opposite to that nearest the Crookes tube there will of course be a space in shadow free from Röntgen rays. This statement, though true in the abstract, may not express the whole truth. It may easily happen that an exploration with a fluorescent screen tube or fluoroscope back of the metal plate will show that the rays are not absent there, but appear to come around the edge of the plate. This phenomenon has been alluded to by Mr. Edison recently and used in support of his suggestion that Röntgen rays are simply high-pitch sound waves.

But upon close examination it will be found that the rays back of the metal shield are, at least mostly, due to diffusion from surrounding objects, the walls of the room or the floor, or objects in the room receiving the rays and scattering them. Further examination will also disclose the fact that bodies differ greatly in their diffusive power, and that substances such as paraffine, wood, paper, pure rubber, cloth of cotton or wool, the hand of a person, etc., which are comparatively transparent to the rays, are also fairly vigorous in diffusing them.

The diffusion is not merely from the surface or irregular reflection. This is shown by the fact that the surface may be smooth or rough and that the rays come even from the back of the object and from portions not exposed directly to the original rays. This indicates a true opalescence like that possessed by opal-glass with ordinary light. It will be seen from this that the shadows of opaque objects imbedded in tissue at considerable depths can never be so black or dense as when the objects are merely surrounded by air. Liquids appear to possess the property as well as solids. The diffusion appears to take place in all directions within and outside of the mass of the substance.

If the fluorescent screen tube used have metal sides of some thickness, the large metal plate screen already mentioned can be dispensed with. In this case it suffices that the screen tube be turned so as to be directed at right angles to the direction of the rays or be turned

1 The term "opale-cence" is here used to mean simply milkiness or cloudiness and without reference to a play of colors

away from the Crookes tube so as not to fluoresce. Pieces of various substances may now be placed opposite the end of the screen tube, but in a position to be partially or wholly exposed to the rays. The pieces will become virtually sources of the rays, and the rays diffused by them, reaching the fluorescent screen, will cause it to emit light.

By placing two exactly similar fluorescent screens at opposite ends of a dark tube and employing a Bunsen photometer screen, movable as usual, between the screens, a comparison of diffusing power of different materials might be made by subjecting the pieces placed near the ends of the photometer tube outside to equal radiation from the Crookes tube. The same instrument might be employed to measure the relative merits of Crookes tubes as producers of the rays. The same electrical discharges could be passed through both tubes while opposite each end of the "fluorometer." So also the comparative values of different fluorescent screen materials could be tested by slight modifications in the use of the instrument.

By comparing the density of the shadow of a piece of sheet-lead when back of a block of wood or paraffine and close to the fluorescent screen with that of the same piece when the wood or paraffine is between the screen and the lead, the effects of diffusion in the latter case in lighting up the shadow are clearly seen on a fluorescent screen.

Though the experiment has not been tried as yet, the writer thinks that a cloud or mass of fine particles of water from a steam jet would diffuse the Röntgen rays.

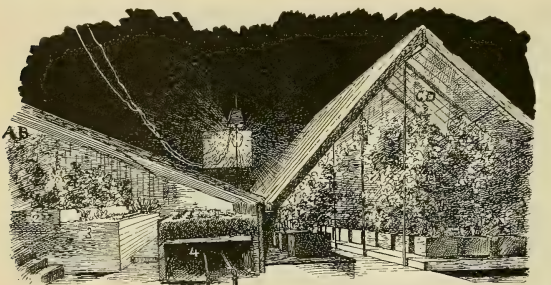



FIG. 1. ELECTRICITY IN HORTICULTURE.—CROSS-SECTION OF THE ELECTRIC LIGHT HOUSES.

It is well known that the higher pitch light waves are most readily diffused and absorbed by fog, and if Röntgen rays be very high-pitch waves similar to light waves, this diffusibility need not surprise us—the new rays to be in a sense detectors of molecular turbidity.

Whether true gases have the power of diffusing the rays is not known, but the diffusive power, if it exists at all, will be small and difficult to detect.

Metal plates gave apparently little diffusive effect, appearing to reflect feebly at angles equal to the incidence angles. The phenomena of reflection from surfaces have been investigated very recently by Mr. Tesla, and a number of values obtained for the relative reflecting powers of metals, etc.

The diffusive action herein noted is different altogether from reflection and is obtained at all angles from the surfaces and from the interior of the materials upon which the original rays fall.

## A Mechanical Absurdity.

There are many electrical engineers who will sympathize with the criticism in the following paragraph, which is taken from the *Railway Review*:

The *Engineering News*, referring to a new electric locomotive which has been designed in this country, somewhat on the idea of the Heilmann locomotive illustrated in our columns last year, pertinently observes that it is sorry that the French are not to have a monopoly of this idea. The plan of combining in a single machine a boiler, engine, dynamo, storage battery and electric motor with the numerous operating and controlling devices which each require, and all for the purpose of propelling a car along a railway track, is one which harmonizes much better with the French mechanic's penchant for complication than the American practice of choosing the simple and most direct means of reaching a desired end. Lest the above note should be misunderstood, we will add that we know of no reason why Mr. Walkin's locomotive, if it is actually built, should not run and perhaps run as fast and haul as heavy a train, or perhaps heavier, in proportion to its weight, than a steam locomotive; it may even be found possible to so manipulate figures as to make an apparent saving by its use. That remarkable feat was performed by the promoters of the Heilmann locomotive, and could, we doubt not, be equally well done here. But no matter how fast the locomotive may run or how skillfully its promoters may present their estimates, the fact will remain that it is a mechanical absurdity to develop mechanical power on a locomotive and then proceed first to convert it into electric current and next to convert that current back into mechanical power in order to apply it to the driving wheels.

## Electricity in Horticulture.

During the last six years experiments have been conducted at Cornell University with a view of determining the influence of electricity in horticulture. The progress of this investigation has been noted in its various stages, and a report recently made by Prof. L. H. Bailey is of special interest. In the early investigations it was determined that the electric light profoundly affects many plants, some injuriously and a few beneficially. Lettuce appeared to be greatly assisted by the light, and some ornamental plants produced earlier and brighter flowers under its influence. The experiments were all made with an arc lamp which hung inside the house, and it was found that better results were obtained when the arc was screened by an opal globe or even by a pane of window glass. The question at once arose if this screen could not be afforded with equal advantage by the glass roof itself if the light were hung above it; and if this were true, it must then be determined how far the beneficial effects of the light would extend, or, in other words, how much glass one light can cover. It is this particular point which the present report considers. The arrangement of the experiment will be understood at a glance from the cross-section of the houses, shown in Fig. 1. It will be noticed that there are two parallel houses, each divided in the middle into two compartments. These houses are 60 by 20 feet. In the valley between these houses the lamp was hung, and the arc was six feet above the nearest glass. The lamp was hung in front of a large, blackened sheet-iron screen, which, in connection with the partition in the house and a series of curtains, completely excluded the light from the compartment behind the lamp. By moving the screen to the other side of the lamp and rearranging the curtains, it was possible to throw all the light into the other compartment; this change was made during the experiment. The lamp is of the 10 ampere, 45 volt, 2,000 nominal candle power Westinghouse alternating current type, attached to an ordinary street lighting system, and it seldom burned after 11 o'clock, while it often ran but an hour or two, and on moonlight nights not at all. The lighted house was exposed to sunlight during the day, and in addition received this small and varying amount of electric light. The other or so-called dark house was lighted by sun during the day and received no light at night. The lamp carried a clear glass globe, so that the light passed through two planes of glass—the globe and the roof—before reaching the plants.

The upper house—comprising the compartments *A* and *B*—is what is termed a cool house, and it was used for lettuce, endive, radishes, beets, spinage, cauliflower, violets and daisies. This is the house in which the experiments were mostly conducted, from the fact that the two compartments of the other house have unlike roofs and are therefore not comparable. Lettuce was grown on benches *1*, *3* and *4*; radishes upon the same, mostly between lettuce plants; beets upon *2*; cauliflowers upon *3*, and the other plants upon *2*. Bench No. 1 is not shown in the illustration. The lower houses *C D* were used for tomatoes, cucumbers and beans, and the experimenters were unable to detect any influence whatever of the light upon these three plants.

The main crop was lettuce, for in previous experiments it was found that there had been a decidedly beneficial influence of the light upon it. This benefit was fully as apparent this year. There can no longer be any doubt as to the advantage of the electric light in the forcing of lettuce. The light was started October 19th. At that time Boston market lettuce four weeks old was set on bench *4*, and seedling plants of Landreth forcing were just showing on bench *3*. The transplanted plants (bench *4*) in the light compartment soon began to excel those in the dark compartment, and as early as October 27th, or a week after starting the light, they were perceptibly ahead of the others. In this time 40 hours of electric light had been expended upon the plants. The plants directly under the light, from seven to 10 feet from the arc, were the first to improve. November 1st the lighted plants were a fourth larger than the others, and they showed a marked tendency to turn toward the light. The plants, even to the farther extremity of the light compartment, gained steadily throughout the experiment, and they were ready for market from a week to 10 days earlier than in the dark house. In quality and all other characteristics, this lettuce was indistinguishable from that grown under normal conditions.

The lettuce on bench *3*—which had been sown there—behaved differently. For the first week or 10 days the plants under the light were stunted, notwithstanding the fact that they were farther from the lamp than those on bench *4*, which did so well from the first. After some days of lingering, when the plants began to acquire three or four leaves, these seedlings began rapidly to recuperate and they finally overtook their companions in the dark house; but these plants never showed the superiority which the transplanted ones on bench *4* exhibited. The experimenters were prepared for this behavior, for they had observed it before, and Dehèrain reported similar results with other plants in his experiments in Paris. It appears to be better to sow lettuce under common conditions, and when the plants are well established to transplant them under the light.

Lettuce was also transplanted into the upper bench, in order to determine how far the influence of the light extends. The extremity of the light compartment was 40 feet distant from the lamp, and the roof is so low that much of the light was reflected, yet at this distance, where there was only diffused light, the plants, at a month after the light started, were much better than in the dark house.

The experiment was repeated with second and third crops of lettuce with similar results, and with several varieties. February 9th Simpson lettuce was transplanted upon bench *4*, and the customary increase under the light took place. March 22d, when the lettuce was nearly large enough for market, the light was transferred to house *B*, and thereafter the poorer plants received the light. These poorer plants soon showed the effect of the new conditions, and the time between the maturity of the two crops was considerably lessened.

Perhaps the best illustration which can be found of the influence of the light upon lettuce was afforded by a crop upon bench 1, into which radishes were also planted. The interception of the light by the radish leaves had a most marked effect upon the lettuce plants which stood behind them, the adjacent plants which chanced to be exposed to the full light being much larger. The bench therefore presented a very uneven appearance when the radishes were removed, and the shadows from the radish leaves could be traced in the lettuce. Similar results were observed where the dense shade of a rafter lay across the plants.

In this connection Prof. Bailey mentions the fact that W. W. Rawson, at Arlington, near Boston, now uses the electric light in the commercial forcing of lettuce. The house shown in Fig. 2 is 33 by 350 feet, covering nearly one-third of an acre. Along the north side of this house are three 2,000 candle power lamps which are run all night. Mr. Rawson calculates that he receives a gain of five days on a crop of lettuce by the use of these lamps, and as he grows three crops during the winter the total gain is over two weeks of time. The gain from one crop is estimated to pay the cost of running the lights all winter. The effect of the light is said to be marked at the distance of 100 feet.

It is also interesting to refer to Figs 3 and 4, showing spinage grown under both conditions Fig 3 shows a plant which grew under normal conditions and Fig. 4 the slender one, under the naked electric light. Prof. Bailey enumerates many other instances showing the effect of the electric light upon plants and flowers. He has compiled statistics on this subject, and from them draws the conclusions that the electric light did not determine the periodicity of growth, that increase under the light occured only during the first days, that growth in both houses took place in daylight as well as in darkness. The experints are thus summarized:

The influence of the electric arc light upon greenhouse

FIG 2 ELECTRICITY IN HORTICULTURE.—ARRANGEMENTS OF LIGHTS IN EXPERIMENTAL WORK AT BOSTON.

plants is greatly modified by the use of a clear glass globe or the interposition of a glass roof. Plants which are much injured by a naked light may be benefited by a protected light. The light can be suspended above the house with good effect. As a rule, plants are earlier under the electric light than when grown in ordinary conditions. Lettuce is greatly benefited by the electric light. , An average of, five, hours of light per night hastened maturity from a week to 10 days, at the distance of from 10 to 12 feet. Even at 40 feet, in only diffused light, the effect was marked. The light appeared to injure young newly transplanted plants. Radishes were also benefited by the light, but not to a great extent. When the light was hung in the house, however, whether naked or protected by a globe, radishes were injured. Beets and spinage appeared to be slightly benefited by the light. Cauliflowers under the light tended to grow taller than in ordinary conditions, and to make fewer and smaller heads. Violets and daisies bloomed earlier in the light house. This corroborates results obtained with other flowers in our earlier experiment. The electric light does not appear to determine or modify the hours of growth of lettuce and some other plants which have been studied in this particular. Plants which are benefited simply grow more rapidly during the customary periods.

Concluding, Prof. Bailey says: "I am convinced that the electric light can be used to advantage in the forcing of some plants."

## Necessity for Advertising Continously.

How many business men flatter themselves that their enterprises are too well known to require special or constant advertising to keep them in the public mind? They do not seem to realize that the great business world has much to occupy its mind and that it is very forgetful. Changes are being made all the time, and the man with whom we are doing business to-day may be supplanted to-morrow by another who is not at all familiar with the special advantages offered by some old house in a particular line. He may not have had occasion to deal with that house, and if he had ever heard the firm's name he may have long since forgotten it, as the house and its wares were not advertised in the publications devoted to that trade. An anecdote told by a Chicago business man affords an excellent illustration of the necessity of constant advertising in order to insure against being forgotten or overlooked. An advertising agent called upon the head of a large commercial house with the view of inducing the merchant to place some advertising with him, but he was met with the statement that the house had reached the point where it was known to everybody in the business and that it was unnecessary to continue advertising on account of its excellent reputation in the trade. The advertising solicitor listened patiently and then turned the conversation into other channels. "By the way," he inquired, "who was the republican candidate for vice-president in the last campaign?" The merchant thought for a moment, stammered and hesitated, and then admitted that he could not recall the name, although he protested it was as familiar to him as his own. Then the advertising man suggested that inasmuch as the candidate in question was one of the best advertised men in the country only a short time ago, it was strange that his name should be so soon forgotten. The lesson was thoroughly appreciated by the merchant, and as he is now a firm believer in continuous advertising, there is no danger of his company's name being forgotten or overlooked by the trade.

## Extension of Dolbear's English Patent on Telephone and Telegraph Cables Refused.

[From the Boston correspondent of the WESTERN ELECTRICIAN.]

Prof. Amos E. Dolbear of Tufts College has just returned from England, where he has been involved in litigation over an extension of his patent on telephone and telegraph cables, which was granted him in England and America in 1882. The suit, which was tried before the Privy Council of Great Britain, involved vast interests both to Professor Dolbear and the English company with which he was associated, since the granting of the extension would have given them the exclusive right to manufacture the cable in England; and the professor, when interviewed on the subject a few days ago, declared himself as confident that the precedent established by a favorable decision in the English courts would have given his suit in this country great prestige.

The British Insulated Wire company, with which he was associated, spent over $20,000 in pushing the claim and was prepared to double the capacity of its plant in case a favorable decision was rendered. It was prepared also to institute similar proceedings in this country. The court decided against it, however, on the grounds of

FIG 3. ELECTRICITY IN HORTICULTURE.—SPINAGE GROWN UNDER NORMAL CONDITIONS.

abandonment, maintaining that no evidence had been produced to show that for the 10 years following the granting of the patent sufficient effort had been made to manufacture the cable.

In his testimony Professor Dolbear attempted to show that at the time his patent was granted there was no call for such a cable, since companies were then permitted to stretch their wires overhead instead of being compelled as now to put them underground.

The invention related to the insulation of electric conductors. It consists in reducing to the smallest possible extent the contact between the conductor and the surrounding insulating material, so that the conductor is as much as possible insulated by the surrounding air. By this means the rapidity with which electric signals can be transmitted through the cable is largely increased, the reason being that the inductive capacity of air is very low as compared with solid insulators, and consequently a much smaller Leyden-jar effect is produced with an air-insulated conductor than with one which is in contact with a solid insulator. By an assignment dated May 25, 1892, the petitioner, Amos Emerson Dolbear, assigned the letters patent for the sum of £10 to "Patent Exploitation, Limited," whose registered office is at Liverpool, and the patent, being assigned to Thomas Kerfoot for the same sum, he about the same time assigned it to James Basnet Atherton, by whom it was transferred to the British Insulated Wire company, which was the registered owner of the letters patent. The petition maintains that it was not until recently that any need existed for cables made according to Dolbear's patent. Notwithstanding the continued efforts of Professor Dolbear to bring the invention into public use, the invention did not come into any commercial use until quite recently, and neither of the petitioners had derived any material profit from it, as shown by accounts filed.

When telegraph and telephone wires were compelled to be put underground a few years ago, such a cable became imperative, and companies in this country and abroad began to manufacture it, ignoring completely the patent issued to Professor Dolbear in 1882. Unfortunately this crisis came during the great Bell telephone litigation, which was such a drain upon the resources of the Dolbear company that it was in no position to resist the aggressions of these cable manufacturers.

"I considered it hopeless to get any recognition or royalty in Great Britain," said Professor Dolbear, "and so in 1892 I sold the British patent for a trifle to the British Insulated Wire company. As the time approached when my patent was to run out, this company applied for an extension of time, and the most distinguished attorney in England and the best electrical experts were engaged to sustain the claims. Fletcher Moulton, regarded as one of the ablest lawyers in England, was employed for the plaintiff, and Dr. John Hopkinson, Mr Preece, Prof. Sylvanus Thompson and Mr. Ferranti testified as electrical experts."

The case was brought to trial on the 18th of March. "At the hearing," said the professor, "no effort was made to show that the cable was not new. The whole case resied upon the inability of the inventor to show why he had not made some disposition of the invention between 1882 and 1892. The witnesses who were called to explain why nothing could have been done were given no opportunity to testify, and the case was brought to a sudden end by the decision that the 10 years of inactivity in behalf of the cable was fatal to the application for a renewal of the patent, which, of course, closed the case."

In case the extension had been allowed, Professor Dolbear was to have received 25 per cent. of the profits as a royalty during the life of the patent. That quarter interest, it was estimated, would have been worth not less than $10,000 annually to him. All that he will get out of it now will be the credit for his invention, which seems to have been pretty clearly established.

## Electrical Progress in Germany.

The State Department has received an interesting report from the United States consul at Chemnitz, Germany, regarding electric street railways in Dresden. In this report the consul states that Dresden is to emulate Hagen, Vienna and other cities in the efforts to get rid of the overhead wiring of electric railways. Experiments are being made with both accumulators and underground wires. Two accumulator cars, drawing each a large trailer car, are now running over one section of the city, while the underground method is to be tried over another. The heating is to be by electricity also. The apparatus consists of a porcelain cylinder bound round with wires of high resistance, which an

FIG 4. ELECTRICITY IN HORTICULTURE SPINAGE GROWN UNDER NAKED ELECTRIC LIGHT.

electric current heats These cylinders are about two inches in diameter and eight inches long.

The street railway in Chemnitz has the overhead system It has thus far given satisfaction and has paid its builders large profits; in fact, it is the best paying enterprise in the city. It was believed that the wires would wear out or pull out from the walls. (The system is one of wires hung from rosettes of iron anchored by means of cement into the walls of houses.) Two years have passed; weather and vibration have done their worst, and yet the wires hang taut and firm as at first. Because of the gloomy forebodings, this system has been watched with a great deal of interest. It has much to

commend it, the consul says, to cities using the overhead system. One feature of it is that it does away with poles. Its chief objection is the danger in case it fall and the difficulties in case of fire.

The consul also reports that the city of Chemnitz has put in sub-stations of accumulators for electric lighting. These consist of cylindrical columns, similar in shape to vertical steam boilers. They are about 12 feet high and five feet in diameter. They are distributed all over the city, and are so situated as to make it almost impossible for the light to fail, even should anything happen at the central station to cut off the current. They act in a measure as reservoirs, holding current in storage. These columns are ornamental rather than otherwise, and serve their purpose well.

## Theatrical Electricity.

Electricity has a function in the mimic life of the stage which is far different from its ordinary hum-drum existence as an illuminant of dark places and the everyday grind of the dynamo for mechanical results. To some extent both these characteristics are called in play, but the great and magnificent displays of light and color for scenic effects, which the subtle element has introduced upon the stage, far outweigh, from the manager's

Ballet in Cinderella.

Cinderella Going to the Ball.

FIGS 1 AND 2 THEATRICAL ELECTRICITY.

viewpoint, all other advantages to be derived from the whirling dynamo.

With electricity it is but a turn of a switch or a regulator lever, or the pulling of a plug, to plunge the stage or the house in Cimmerian darkness or "dim" down any section, and as instantaneously to restore the illumination to its brightest effulgency. All the colors of the rainbow are easily accomplished; the "foots," as the ungrammatical prompter calls the footlights, are of several colors, changeable quicker than the dissappearing coin at the bidding of a Herrmann or a Kellar, from blue to red or white, as the electrician wills, while the fiercer displays required for a storm setting, when huge flashes accompany the sheet-iron thunder of the assistant in the wings, is just as easy of accomplishment—a wonderful improvement on the lycopodium torch, far more realistic, more readily handled and many times safer. Electricity will blow up a mine, burn a house, play the rôle of an enraged thunderbolt on occasion, and yet the cosiest of grate fires is readily manufactured by a combination of broken bottles and a half-dozen colored incandescent lamps for a stage parlor scene. It makes excellent stars, the brightest of locomotive headlights, and for suns and moons it has no equal.

But there is another and more delicate use for the glow-lamp: a decoration for the sylphs of the ballet, who carry a storage battery in one pocket which, at will, by closing a diminutive key, lights up pigmy lamps attached to the dress. If a second is closed the performer's tresses blaze like diamonds, a third, and a necklace shines out in varegated colors. The keys are in the palms of the hands, and are manipulated by the fingers. The wires are small and are invisible to the ordinary looker-on. Sometimes, too, the contact is made through the slippers, when standing on certain marked spots in the floor.

The duel scene in "Faust" is managed in this manner. When his infernal majesty strikes up the sword of the combatants they form contact with one side of the electrical source, and he is standing on the other; crossing the swords closes the circuit, and the fire flies, of course.

A remarkably attractive spectacular piece on the Drury Lane, London, stage shows how far the electric light may be made decorative. The cuts here reproduced are from the London *Electrical Engineer*. Fig. 1 shows the apotheosis terminating a grand ballet, while Fig. 2 represents the moving chariot of Cinderella of glass-slipper fame. In the first of these the miniature lamps diplay in the bands of the three central dancers the figures 1896, while in the upper portion of the group are seen a horseshoe, heart, arrow, star and crescent, and an anchor, all similarly illuminated. In the second, the good work of the fairy god-mother, who unfortunately belonged to a now extinct race, is passing, on the way to the ball, in review before the good genius who assists her.

## New York Legislature Deals Kindly with the Bell Company.

As intimated shortly after the introduction of the bill in the New York Legislature providing for the regulation of telephone charges throughout the state, the measure has met the usual fate. According to the *New York Herald*:

The common charge that corporations are secure against any adverse legislation at Albany which the Republican machine can control seems to be substantiated by the fate of the telephone bill, which was killed in the Senate on Tuesday.

This measure was solely in the public interest, being designed to protect the community against the extortionate charges of a monopoly. It was made so fair and just to the companies affected that no reasonable objection could be urged against it, and we believe no attempt to urge any was made. Yet it was summarily voted down, as were all the previous bills introduced to attain the same end.

That this result is due to some mysterious corporation influence rather than public considerations, will be the general impression. It is but another triumph of the telephone lobby over the community, which is far from creditable to the Legislature.

Wm. Curlett, Alfred Davis and Benj. F. Arksey have been appointed as a committee by the council of Dexter, Mich., to investigate various systems of electric lighting, and to receive propositions for the proposed plant in that town.

## Transmission of Niagara Power to Buffalo.

[From the Niagara Falls correspondent of the WESTERN ELECTRICIAN.]

The Niagara Falls Power company has filed with the Board of Public Works of Buffalo the plans for the distribution of Niagara electric power in that city so far as it is prepared to place itself on record. This action is in accordance with the franchise granted the company. In this connection it is most interesting to recall that the officials of Buffalo took over one year to consider the provisions of the franchise, and also to point out that there must now be general disappointment on the part of Buffalonians over the rare simplicity of the plans filed. It is clear that if the city officials thought to force the company to file plans of all the lines they ever intended to build, the power company does not understand it that way, for the plans provide for only two trunk lines and two short lateral lines. Of these, only the two lateral lines, aggregating less than half a mile in length, seem to come under the jurisdiction of the city authorities, as the trunk lines are to be built entirely on private property and land owned by the state. In order to secure this right on state lands—canal property, by the way—the Niagara Falls Power company has availed itself of the rights secured from the state by the Cataract General Electric company, the latter company having granted the Niagara Falls Power company a permit to erect its transmission line along the canal. This action has aroused the criticism that the Niagara Falls Power company and the Cataract General Electric company are practically one and the same, but this is not a fact. The present understanding is that the poles of the transmission line will be placed about 20 feet distant from the water line. The wire will be at least 28 feet above ground, and where it crosses the canal it will be fully 150 feet high. A transformer house will probably be built on state property at the Buffalo end of the line.

The transmission line plans filed provide for a line along the river side of the canal bank from the Buffalo city line to the foot of Hamilton street, where the wires are carried over the canal, and continue on the city side to a point between Amherst and Parish streets. Here they cross the canal again, and continue to the state sea-wall, which they strike near the old ship-lock. The wires are carried on the sea-wall to the Queen City Mills at the foot of Breckenridge street, where they cross the harbor at an elevation to the canal bank again, continuing along the river side of the canal to the foot of Commercial street. The line, which is called trunk line A, is tapped at two points—at the foot of Fort street, where the lines are carried by a conduit under the canal and up Fort street to the Buffalo Railway company's power house, and at the foot of Court street, where the wires are carried over the canal and into an underground conduit running up Court street to the plant of the Buffalo General Electric company. Trunk line B, of which a separate plan is filed, shows the route of the New York Central belt line, the plan being to erect poles and run wires around the city by this line, which is fed from the main line by the wires running up Fort street. The third plan is a small one, showing a cross section of the conduits proposed to be used.

When the plans were filed the Niagara Falls Power company addressed a letter to the Board of Public Works which certainly is an interesting document. It opens with the statement that "Pursuant to the provisions of the francise by the city of Buffalo for the introduction of electric power within the corporate limits of said city, adopted by the Common Council on December 23, 1895, secured by his honor the Mayor on December 16, 1895, and accepted by the Niagara Falls Power company January 14, 1896, and in compliance with the first and tenth sections of said franchise, the Niagara Falls Power company herewith submits its plans and specifications referred to in the first section for the approval of your honorable board." Continuing, the letter is as follows:

The tenth section of the franchise provides that the company shall be prepared to supply 10,000 horse power to consumers within the city on or before June 1, 1897, and shall submit the plans and specifications referred to in the first section for approval within 90 days after the acceptance of the grant. Although the franchise was under consideration by the honorable Common Council for over one year, and 90 days after its acceptance by the company have nearly expired, the only applicants in the city of Buffalo for the power to be furnished by the company are the Buffalo Railway company and the General Electric company of Buffalo. Until applications from other consumers have been received by the Power company under the terms of the franchise, and until the Power company knows in what parts of the city power will be taken,

and in what amounts it will be required, it will be impracticable to present definite plans for general distribution to different points in the city beyond those necessary for the supply of the two applicants above mentioned. For this reason the plans herewith submitted are confined to two general trunk lines, from one of which lateral lines are shown, and others may be extended hereafter as the demand for power in the city is made known to the Power company. Trunk lines within the city are shown upon two maps herewith submitted, "A" being a map of a trunk line beginning at the intersection of the northern line of the city with the Erie

FIG. 1. ELECTRIC TURRETS OF THE LATOUCHE TRÉVILLE.

canal and extending thence upon Erie canal lands to the foot of Court street, and "B" being a map showing a proposed trunk line upon lands of the New York Central & Hudson River Railroad company, known as the Belt Line, extending around the city.

In regard to the trunk line shown on the map "A," as it is wholly upon state lands and without the jurisdiction of the city authorities, it may be considered unnecessary to present written specifications of the electrical conductors, wires and poles of which it is composed. For the information of your honorable board, however, it may be stated that it is intended that this line shall be composed of a pole line as shown upon the map "A," consisting of poles not more than 100 feet nor less than 50

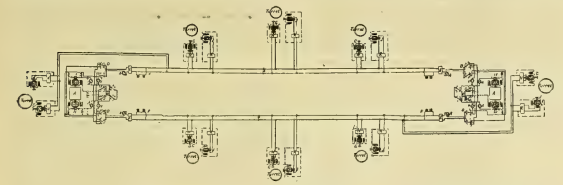


FIG. 2. ELECTRIC TURRETS OF THE LATOUCHE-TRÉVILLE.—PLAN OF ELECTRICAL PLANT.

feet apart, erected in the most substantial manner, imbedded in the ground not less than six feet below the surface, and erected at the points indicated on said map; that the conductors for the delivery of 10,000 horse power generated at Niagara shall consist of not less than three nor more than nine copper cables, each about six-tenths inch in diameter, not less than 22 feet from the surface of the ground, and at places of special crossing of such greater height as shall be approved by the superintendent of public works of the state of New York; that the conductors shall be carried upon porcelain insulators of special pattern designed for this work, and that lightning arresters and other safety appliances of the most approved character known to electrical science shall be employed in connection with such line.

From this trunk line it is proposed to construct two lateral lines, one extending from the canal lands at the foot of Fort street, along Fort street to the power station of the Buffalo Railway company, and the other extending from the canal lands at the foot of Court street, along Court street to the station of the General Electric company of Buffalo, between Franklin and Pearl streets. These two lateral lines, being the only necessary lines to supply the first 10,000 horse power generated by the Power company at Niagara, to meet the present demand in the city of Buffalo, are to be underground conduits, constructed in streets designated, in such route on said street as shall be approved by the city engineer for the purpose of avoiding any existing lines of conduits, gas or water pipes. These conduits are to be constructed of cement or vitrified clay of the type known as the Powers tellmic duct, or the H. B. Camp company's duct, drawings of which are herewith submitted, marked respectively (a), (b), or other duct of not inferior character. Each of said conduits is to be laid so that the top surface thereof shall be not less than 18 inches below the grade of the street, and each shall contain not less than 18 holes, each hole not less than three inches in diameter, nine of which holes shall be for the use of the company and nine of which shall be reserved as prescribed under the second clause of the franchise. Extra ducts are shown for the use of the city fire alarm and police wires, as prescribed in the same clause of the franchise. The conductors used in each of said conduits are to be cables of copper wire, and each cable completely covered with insulation of standard vulcanized rubber. These underground cables, from the main lines on the canal lands to the points of use designated on the map, are to carry not more than 20,000 volts.

Trunk line B may be erected upon the lands of the New York Central & Hudson River Railroad company, known as the Belt Line, to consist of a pole line similar in construction, material, conductors and insulators to that already described as to be erected upon the canal lands, and the jurisdiction of the municipal authorities under the franchise in respect of such pole line will appertain only to those points where such conductors cross highways or streets of the city. It is not proposed to erect any poles of any such trunk line upon the streets.

The plans for the trunk line upon the canal lands within the city have been approved by the superintendent of public works of the state of New York, and a permit therefor issued.

This letter bears the signature of Benjamin Flagler, who is vice-president of the Niagara Falls Power company. Although it has been quite certain for a year or more that Niagara power is to be transmitted to Buffalo, the letter announces that so far but two applications for power have been received, these applicants being the Buffalo Railway company and the General Buffalo Electric company, the latter company desiring current for lighting purposes.

## Electric Turrets of the Latouche-Tréville.

The Latouche-Tréville is a recently constructed man-of-war of 4,750 tons displacement, at a depth of six meters, which measures 110 meters in length by a breadth of 14 meters. Her engines are of 8,300 horse power and her speed is 19 knots per hour. Her armament is composed of two 19 centimeter guns, six of 14 centimeters, four of 65 millimeters, four of 47 millimeters, 10 revolving guns and five torpedo tubes. She was launched at La Seyne and presented a fine appearance, as is shown in Fig. 1. The 19 and 44 centimeter guns with which she is equipped are protected by Canet turrets, the first type being placed at the bow and stern, the others being ranged three on either side of the vessel. Each of the 14 centimeter guns is protected by a turret completely closed. These eight turrets are maneuvered by electricity.

Perfect work demands the fulfillment of several requirements: The massive tower and gun must be capable of turning at graded speeds, stop and start without delay, move right or left at will, answer with precision and readiness the least motion of a small lever, etc. These motions are of complicated character, and the instantaneous stopping at the extremities of the course necessitated a careful study in their accomplishment.

The Canet turrets thoroughly accomplish everything required. The variations in speed are controlled by the graded resistance coils of a rheostat.

An electro-magnetic key automatically cuts off the current, and through the aid of special stops, two in number in each turret, easily arrests the motion to right or left when the limit is reached. Each stop comprises a cylinder of insulating material, within which a sliding contact acts at the proper moment to control the movement of the turret, and the speed due to the inertia of the mass is counteracted by short-circuiting the motors.

The movement of a single lever controls all these results, in either direction, the return of the lever to a point of repose reversing the result.

The gunner has thus at his command a rapid and accurate method of general aim, while for more perfect training of the piece a small number of successive attempts are necessary.

The electric energy required for the eight turrets of this vessel is obtained through two generators of 30 horse power each, installed at either extremity of the vessel, as shown in Fig. 2.

The two engines *A A'* are direct-coupled to the shunt dynamos *I., II., III., IV.* Three switches, *C, D, D'*, allow the placing of the dynamos separately in circuit, and placing them in parallel or in series, as required by the exigencies of the case.

In the illustration Fig. 2, the different circuits are represented as follows:

——— Positive feeders.
– – – – Positive of the motors.
▬▬▬ Negative feeders.
▪ ▪ ▪ ▪ Negative of the motors.
. . . . . Positive of the dynamos.
▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪ Negative of the dynamos.

The current from each dynamo flows through an ammeter *A* and a voltmeter *V*, with switches placed on the various circuits. Each positive circuit is thus furnished with an ammeter, a double switch *F*, and a cut-out *F'*.

The eight turrets have each two motors, *G*, in series, and a third for handling the projectiles. The former are wound in derivation, with two cut-outs, and a switch *H* in the armature circuit.

In each turret, under control of the chief gunner, is a cylindrical box with a lever handle, which controls the movements of the turret, like the controller of an electric railway. Messrs. Canet and Hillairet have applied the name "electrical cartridge" to this controller, which is represented in Fig. 3.

The "cartridge" contains a switch for controlling the movements of the motors, connections for electrically obviating the shock in sudden movements of the turret, a reversing switch, an electro-magnetic key, a lever with contact pieces for short-circuiting the motors, a spring for automatically returning the moving parts to their normal position, and lastly a switch and a rheostat composed of flat sections placed one above the other. This regulating apparatus is inclosed in an iron cylinder, bolted at the bottom and covered by a sheet-iron top. At the upper portion is seen a collar, which fits tightly around the movable shaft, the latter being furnished with a spring, tending to hold the lever in a neutral position, and a clutch is provided for maintaining the handle in any desired part of its travel.

In the series of tests to which the turrets were subjected before acceptance, the following results were recorded: Thirty seconds for displacing the 14 centimeter guns through an arc of 180 degrees, and 50 seconds for a similar movement through 300 degrees of the 19 centimeter pieces. *L'Electricien*, from which the illustrations are copied, says that all the important problems in naval advantage are answered in this form of construction, which renders useless the class of guns to which the Gatling and the Hotchkiss belong.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

An independent company is getting in an exchange at Marshalltown, Ia, and has partial service now.

The Central Union Telephone company, at Des

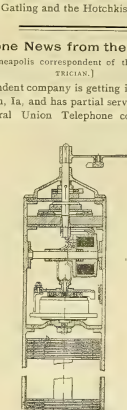


FIG. 3. ELECTRIC TURRETS OF THE LATOUCHE-TRÉVILLE. DETAILS OF ELECTRIC CONTROLLER.

Moines, Ia., has applied for a 50 year franchise and offers to place its wires underground and erect an office building to cost $150,000, if it is granted. A co-operative telephone company has secured 700 subscribers and is preparing to construct an exchange, which is believed to be the cause of the sudden desire to improve on the part of the Central Union.

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CORRESPONDENCE.—Relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

## HIGH WATER MARK

**CIRCULATION, 16,630.**

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THE publication offices of the WESTERN ELECTRICIAN have been removed to much more commodious quarters. Our new address is Suite 510 Marquette building, Dearborn and Adams streets, Chicago.

The telephone number remains unchanged—Main 1746.

WE are gratified to learn that the Northwestern Electrical association has determined to be represented at the convention of the National Electric Light association, as suggested in the last issue of WESTERN ELECTRICIAN. President Baker's letter on this subject, printed on another page, shows that the Northwestern Electrical association is animated by the proper spirit and that the directors of that vigorous young organization, with true western enterprise, are striving earnestly to take advantage of the experience of older associations. We congratulate the organization upon this new indication of its progressive spirit.

OUR eastern contemporaries are still wrangling over their respective claims to extreme senility, and the reader is forced to the conclusion that they must all be in their dotage. The electrical fraternity has proper respect for old age, but experience has proven that for practical results the live, enterprising, up-to-date journal is by far the most valuable medium of communication; hence the popularity of the WESTERN ELECTRICIAN, which is recognized by the trade as vastly superior to its venerable contemporaries. We are content to let our eastern friends establish to their full satisfaction the reputation of "has beens." The WESTERN ELECTRICIAN is the journal of the age in which we live.

THERE is no danger that the currency question will be allowed to disappear from public view. Allen Ripley Foote has taken up the subject, and as chairman of the National Association to Establish a Sound Currency and Banking System, has begun issuing circulars dealing with financial questions. The association was conceived in the fertile brain of Mr Foote, and it is announced that its first action will be to select a non-partisan board of referees, of the highest ability, to consider all propositions presented and to formulate a statement of principles designed to be incorporated in platforms of all political parties, the application of which, in practical legislation, will result in establishing a sound currency and banking system. When this is accomplished Mr. Foote may possibly be induced to turn his attention to the consideration of other public questions.

EXAMINATION of the specifications and accompanying drawings for underground electric railway patents recently issued suggests the idea that it might be well for the examiners to inform themselves of the work done in this field during the early stages of development. Among the so-called improvements upon which patents have been granted lately there are many that bear a striking resemblance to discarded devices that were found impracticable by the early experimenters in this field. The records of these investigations should be carefully studied by the experts at Washington if they would act intelligently upon the applications that are submitted for their consideration. The story of these early experiments forms an interesting chapter in the history of electrical development in this country, and its perusal should prove profitable and entertaining. It is of absorbing interest to the student of industrial progress, too, for it depicts struggles and hopes and disappointments experienced by the poor inventors who were attempting to perfect a system, meeting only opposition where they had a right to look for encouragement and assistance.

GOOD service and careful management form an excellent combination in any industrial enterprise, but in no place is it more absolutely necessary to observe these requirements than in central station practice. That they are appreciated is shown by the measure of success that has rewarded the companies that have adhered closely to these principles. The record of one central station man who is widely known among those who will gather at the convention of the National Electric Light association may be cited as an illustration. George A. Redman, general superintendent of the electrical department of the Rochester Gas & Electric company, has compiled some figures which show that the central stations under his management in Rochester, N. Y., a city of 150,000 inhabitants, supply current for 3,540 arc lights, 36,500 incandescent lamps, and motors aggregating 1,780 horse power. This is certainly a remarkable showing. It indicates that the people of Rochester appreciate the progressive spirit of the company and it reflects credit upon the management of the corporation furnishing this service. It is worthy of mention, too, that Mr. Redman, who is ever on the alert for new ideas and suggestions of practical value, always attends the conventions of the National Electric Light association, believing that the time and money expended at these meetings are profitably invested. This should be carefully considered by the stay-at-home managers who labor under the delusion that they cannot absent themselves from their business a few days every year

WHAT is known as the village waterworks bill, now pending before the New York Legislature, is being opposed on the ground that the real animus of the measure is the protection and extension of the powers and privileges of the Niagara electrical power corporations. As originally drawn, the bill applied only to water works in villages. It provided that where a private water company was in business the village should not construct water works of its own without buying the plant of the private company, but the bill has been amended and, as it stands, it now provides that no city or village shall supply water or electric power or carry on any other business without first buying out the companies already organized. It is claimed that the interest of the big Niagara corporations arises from the fact that they expect to be able to transmit current along the canal and sell it to little companies to be organized in the cities and villages; and if this bill become a law, it is declared, there will be no way for cities or villages to get rid of these companies and supply their own electricity without buying the companies out. The bill in question very properly recognizes the property rights of established corporations, and every sense of justice and equity demands the protection of these interests. Aside from these considerations it should be borne in mind that any policy that will jeopard the business of a community should be avoided. Instead of alarming capital and driving it away, every town and city should encourage investment and guarantee full protection of vested rights.

WHILE approving the action of Mayor Swift in vetoing the ordinance for a street railway line on Jackson street, the Chicago daily newspapers point out the inconsistency of the position thus assumed. One of the mayor's reasons for vetoing the Jackson street railway ordinance, as given in his message to the City Council, is as follows: "It [the ordinance] allows a street railway line with an overhead trolley across the Jackson street bridge and along East Jackson street to Michigan avenue. This is something to which the people of this city are, in my judgment, overwhelmingly opposed." Mayor Swift permitted the ordinance for a trolley line on South Clark street to pass, and signed other ordinances for trolley lines across bridges and on streets quite as necessary to free public use as Jackson street, and the inconsiderate newspapers now intimate that the real reason for the veto was the fact that the measure was opposed by Messrs. Yerkes and Wheeler, who feared the competition which this new line threatened. Very little sympathy will be wasted upon the projectors of the Jackson street railway, because of the methods employed, but there are other interests involved indirectly in Mayor Swift's veto that demand consideration. It is rather a late day for his honor to disapprove ordinances because they provide for overhead trolley lines. The great masses of the people approve this form of construction because of the benefits they derive from the improved service, and they give substantial encouragement to projects of this class by their liberal patronage. The overhead trolley has secured a firm foothold in the city of Chicago, and it has gained the support of the public because of the superiority of the service over all other forms of transportation that this city has thus far enjoyed.

DETROIT's eccentric mayor is making some very remarkable statements in the speeches he is delivering nightly through Northern Michigan before the Republicans, whom he is trying to induce to nominate him for governor. He is basing his plea for their support upon his record as chief magistrate of the city of Detroit, and he "points with pride" to his potato patches and his lighting plant. It is evident from his assertions concerning the operation of the city lighting system that he is not familiar with the details of that branch of the municipal service. This sturdy opponent of corporations claims that the annual cost of the city lights in Detroit is only $60 each. We assume that this is a mistake and that it is probably due to the fact that the ambitious mayor is devoting so much attention to his gubernatorial canvass that he has not kept himself thoroughly imformed of what is going on in his own bailiwick. We do not wish to charge the distinguished executive officer of Detroit with deliberate misrepresentation in this matter, nor do we think that the city lighting commission has been stealing the city funds. But we do know that the taxpayers of the city of Detroit are paying more than $60 per lamp per year; in fact, competent experts who have examined this special case declare that $120 per lamp per year will scarcely cover the expenditure, and this, too, with the plant running under the most favorable circumstances. We would commend to the careful consideration of the distinguished Wolverine the article on the "Economy of the Detroit Municipal Plant," published in this journal on February 22, 1896, and we would advise the good people of Michigan and elsewhere who may have the pleasure of listening to the distinguished exponent of agriculture in municipalities to investigate for themselves the accuracy of the Hon. Fingree's assertions, even though we fear that that estimable gentleman's reputation for veracity and accuracy may suffer in consequence.

## Arrangements for the Western Delegation to N. E. L. A. Convention.

Interest in the convention and exhibition to be held at New York under the auspices of the National Electric Light association next month is increasing among western representatives of lighting interests, as well as supply men and manufacturers. Many inquiries have been received about the schedule for the special train that will carry the Chicago delegation to the meeting. At many points along the route, it is expected, there will be received additions to the Chicago party, and it is evident that a number of cities in the vicinity of Chicago will contribute to the delegation that will start from this city. Among the points from which inquiries have been received are: Denver, St. Paul, Omaha, Milwaukee, Kansas City, Peoria, Minneapolis, Racine and other smaller places. As announced last week, the St. Louis delegation will arrive in Chicago on the morning of May 2d, and after a day in this city start for New York on the special train at 5 P. M. It may be well to explain that the arrangement with the C. & A. Railroad company which Bryan & Humphrey have made provides that the round trip by way of Chicago shall cost the delegates only a fare and a third regular rate between St. Louis and New York). At Cleveland a considerable addition to the party is expected. L. H. Rogers, who is in charge of the arrangements in that city, hopes to have a large delegation, and it is quite probable that the Cincinnati men, under J. C. Hobart, will also join the special train at this point. The Detroit contingent will be taken on at Toledo, and it is possible that several central station men and engineers from Michigan towns will join Mr. Lockwood's party. It is also expected that some arrangement will be made by E. H. Heinrichs to have the members from Pittsburg and vicinity join the Chicago party at Erie or Buffalo. Messrs. Wilbur and Byron of the Lake Shore have completed arrangements for the running of the special train, and they announce the following time-card:

SPECIAL TRAIN SCHEDULE, CHICAGO TO NEW YORK, VIA LAKE SHORE AND NEW YORK CENTRAL RAILROADS, MAY 2-3, 1896.

| | | | |
|---|---|---|---|
| Leave | Chicago, | Van Buren street depot | 5:00 P. M. |
| " | " | Twenty-second street station | 5:08 " |
| " | | Elkhart | 7:35 " |
| " | | Toledo | 10:40 " |
| " | | Sandusky | 11:45 " |
| " | | Cleveland | 1:35 A. M. |
| " | | Erie | 5:54 " |
| Arrive | Buffalo | (Central time) | 6:05 " |
| " | " | (Eastern time) | 7:05 " |
| Leave | " | " | 7:15 " |
| " | | Rochester | 8:50 " |
| " | | Syracuse | 10:45 " |
| " | | Utica | 12:07 P. M. |
| " | | Albany | 2:20 " |
| Arrive | | New York | 6:00 " |

It should be understood that all arrangements for transportation upon this special train must be made in advance, and in order to take advantage of the special arrangement that has been made with the Lake Shore company and get the advantage of the reduced fare, delegates must file their applications at the railroad company's ticket office, Fort Dearborn building, Clark and Monroe streets, or with W. A. Kreidler, Suite 510 Marquette building. C. O. Baker, Jr., writes that he will probably come to Chicago at that time in order to accompany the western delegation to New York.

## National Electric Light Association.

The Murray Hill Hotel, Forty-first street and Park avenue, New York, has been selected as the hotel headquarters for delegates to the nineteenth convention of the National Electric Light association, May 5th, 6th and 7th. It is stipulated, however, by the hotel management that none of the guests make use of any part of the hotel for exhibition purposes or display any signs or placards in the halls or corridors. The exposition to be held under the auspices of the association will be opened May 4th in the Industrial Building, two blocks from hotel headquarters.

## Northwestern Electrical Association Will be Represented at the New York Convention.

*To the Editor of the* WESTERN ELECTRICIAN:

In your publication of April 18th I notice that you consider it the proper thing for our association to be represented at the National Electric Light association convention, to be held next month. I desire to state that our directors have already taken the matter up and have decided upon sending our secretary, Thomas R. Mercein of Milwaukee, to represent this association. Mr. Mercein will go purely in the interests of this association, and will return with full reports, which will be read at our meeting in July.

W. B. BAKER,
President Northwestern Electrical association.

## National Electrical Exposition.

The announcement was made last week of the generous offer of the Western Union Telegraph company of two wires from Niagara with which to bring current from the power plant there to run the model of the plant at the exposition. These wires will be available in the evening, and the question thus arose as to what should be done in the way of running the model the rest of the time during each day. A. S. Brown, the electrical engineer of the Western Union Telegraph company, suggested that it would be a comparatively easy thing to ship a few storage batteries to Niagara, charge them there and bring them down for the purpose. This suggestion has been acted upon, and the Electric Storage Battery company of Philadelphia, through Charles Blizard, its New York representative, has placed at the disposal of the exposition all the batteries that may be needed, with the permission to utilize this stored Niagara energy for any other exhibit at will. There will thus be exhibited the energy of Niagara in a "live" form, coming over the wires in the shape of an alternating phase current, to drive the model by a phase motor, and the stored Niagara energy, which will, of course, be applied to a direct current motor, which will also run the model part of the time. A more interesting illustration of the flexibility of electrical power transmission than this could hardly be desired, as it practically embraces the whole field of modern methods and appliances.

In connection with the opening ceremonies of the exposition, when it is proposed to start the machinery by a circuit that has first looped in the whole continent, the Postal Telegraph-cable company, through its vice-president, W. H. Baker, has very courteously offered its fine service between New York and San Francisco for the purpose. The Postal company has been equipping its lines with heavy copper circuits, and believes that it can illustrate rapidity of working by the instantaneity of its transmission on May 4th, when the mere pressure of the golden key will flash the signal to the Golden Gate and back to the exposition building in the twinkling of an eye. Arrangements are now being made with the Postal company for the execution of this interesting plan, with the cooperation of the long string of offices scattered over the 6,000 miles of wire.

In view of the importance of the occasion, the exhibit of the United States Patent Office will be made of unusual size and interest. As now arranged by the department, under the instructions of S. T. Fisher, the acting commissioner, it will include no fewer than 361 separate models of electrical devices, apparatus, machinery and appliances, many of them embodying the fundamental and elementary ideas upon which the modern electrical arts have been founded. These models will occupy over 300 linear feet, and will be carefully grouped and classified, so that students of whatever character can follow the general lines of growth or evolution.

Cornell University is among the many contributors of interesting objects at the electrical exposition. It is in possession of the Gramme dynamo built by Professor W. A. Anthony as early as 1876, and exhibited as a great curiosity at the Centennial Exposition of that year. It was probably the first dynamo of practical form constructed on those lines in this country. It was used for arc lighting and for a great variety of purposes in those early days. It has remained in use ever since, and Dr. E. L. Nichols writes that even now it is in use at the university. The art has seen many remarkable evolutions, making this machine as great a curiosity in 1896 as in 1876, and it will doubtless be a center of attraction to all students of dynamo construction. Cornell is also exhibiting other things of interest, and its work for the success of the exposition is but natural in an institution that benefitted so nobly by the first fruits of electrical invention and industry. It may be added that other very early dynamos are to be shown.

In spite of many pressing engagements, Professor Elihu Thomson is preparing a very interesting personal exhibit. He hopes to ship it to New York from New England in a few days. He has been requested by the management to include in it some of the working apparatus illustrative, in many beautiful ways, of the "repulsion phenomena," his classic investigation of which some years ago is well remembered. An endeavor will also be made to secure a lecture from him during the exposition, as it is understood that he will be in New York at that time. He is one of the most successful lecturers of the time in explaining electricity popularly and clearly. A bust of Professor Thomson is now being made by the Riccinilli Brothers of New York, under the direction of the sculptor, Robert Kraus of Boston. It is expected to be finished by the end of the month, and the original has consented to its inclusion in the collection of busts and pictures that will adorn the space of the loan and historical exhibit committee.

An exhibit that is sure to arrest the attention of the numerous visitors to the exposition will be that which shows a stock ticker system in full working operation. To watch the tape unroll with the curt little signs on it is one thing, but to see how the information that means so much to the financial world is gathered and put on the circuits, is another matter of interest to everybody. The developmeat of the modern stock ticker system, so strikingly American, is the result of much ingenuity and enterprise. With the object of assisting to a better understanding of the subject, the executive of the Gold & Stock Telegraph company has generously authorized its superintendent and electrician, George B. Scott, to place at the disposal of the exposition management a number of old instruments that will be useful in showing how the system as it exists to-day has been worked out to its present stage of efficiency and celerity. Mr. Edison and others are also contributing apparatus of this nature, rendering the display one of unusual value, as such electrical machinery has never been brought together before in this instructive manner.

Among the companies taking a lively interest in the approaching exposition is the Interior Conduit & Insulation company of New York. That concern has taken considerable space in the exposition hall, and will show in operation a printing press run by a directly connected Lundell motor. Exhaust fan outfits 60 inches, 36 inches and 12 inches, a directly connected generating set, Lundell power motors, Lundell generators, Lundell desk fan motors and ceiling fan motors, Lundell dental outfits, Lundell emery wheel grinder, Lundell buffing machine and a Lundell organ blowing outfit will be exhibited. The latter outfit will be attached to a Mason & Hamlin organ which will be played each evening. The company will also exhibit its complete system of plain, brass armored and iron armored insulating conduits, as well as its complete underground conduit system. Another feature will be an illuminated sign 30 feet in length. The following named gentlemen will be in attendance and explain the various novelties: D. C. Durland, George H. Kimber and E. B. Kittle.

The Adams-Bagnall Electric company of Cleveland promises to exhibit the most extensive and most comprehensive line of arc lamps ever shown by one concern in the world's history. There will be on exhibition, and in running condition, one black japan series lamp, shunt; one 17th century brass series lamp, differential; one oxidized copper 100 hour lamp; one aluminum 100 hour lamp; one yellow brass alternating lamp, 1,600 alternations; one japan copper alternating lamp, 7,200 alternations; one oxidized silver constant potential lamp; one oxidized brass constant potential lamp; one marine lamp, black japan; one 100 hour old gold lantern; one nickel railway lamp to run nine or 10 in series on the railway circuit. The arc lamps will be of the improved "A-B" pattern. The "A-B" incandescent lamps will also be shown. This lamp is devoid of the unsightly glass protuberance. The arc lamp may be subjected to close inspection and examination by any callers interested in the subject. Testing instruments will be in circuit, and any of the lamps may be tested at any time during the exposition.

Considerable preparation has been made by Huebel & Manger of Brooklyn for their display at the exposition. The firm announces that it will show many attractive novelties, and that both Messrs. Huebel and Manger will be on hand, as well as W. W. McChesney.

## The Technical Club.

The newly organized Technical Club of Chicago is receiving hearty support. It is designed to supply the benefits and pleasures of a social club to any successful applicant who is "an engineer or architect or connected with or specially interested in engineering work." The membership is limited to 500, and the enrollment has reached about one-half of the constitutional limitation. Club rooms have been secured at 228 and 230 Clark street. This location is excellent, as it is in the immediate vicinity of the Rookery, Western Union, Monadnock, Marquette and other office buildings largely peopled by engineers and men of allied occupations. The club will use the three upper stories of a four-story building, each floor being 40 by 125 feet. Dankmar Adler, the famous architect, has prepared plans for remodeling the rooms to suit the purposes of the club, and it is expected that the work will be completed some time in June. The space

will be divided into library, assembly, lounging and billiard rooms, public and private dining rooms and rooms for the use of technical societies working on kindred lines. The building is well situated for light and ventilation, having wide alleys on the side and rear. It will be heated by steam, lighted by electricity and equipped with an electric elevator. One of its popular summer features will be a roof garden.

The Technical Club's membership is not confined to residents of Chicago, but provision is made for the affiliation of non-residents. The entrance fee is $50, the annual dues of resident members are $30, and the annual dues of non-resident members are $20. Non-residents are those who do not reside within 50 miles of Chicago. Robert W. Hunt is president, Charles E. Billin is secretary and H. F. J. Porter is treasurer. The committee on admissions consists of Alfred Noble, B. J. Arnold, James R. Chapman, E. M. Herr and Isham Randolph.

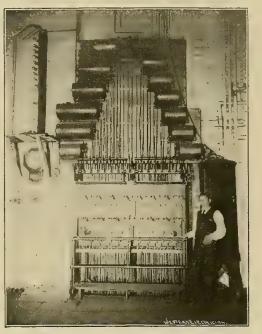
## Use of Electric Power in Middletown, O.

One of the most interesting modern stations in the country, and the first, perhaps, which has a larger motor load than a lighting load, is that at Middletown, Ohio, operated by the Middletown Electric Light & Power company. Four months since F. H. McKnight, president and general manager, determined on an increase in his station, which, up to that time, had been operated on a small scale only. The conditions with which he was confronted showed the necessity for a system of distribution which would allow him to cope with a large demand for current for motor service during the day and a similarly large one for lighting after dark. Mr. McKnight selected the monocyclic system of the General Electric company to meet these conditions.

The power house (Fig. 1) is large and well ventilated, and is situated near the center of the city in an ideal location for an electric station. It fronts on the Cleveland & Cincinnati canal, while immediately behind it are the tracks of the M. & C. railroad. Water for the station is taken from the canal in front and the necessary coal is shoveled directly into the bins from the cars standing on the tracks behind.

The steam equipment consists of two Brownell and Dayton boilers, furnishing steam to one 250 horse power Russell engine and one 100 horse power Ball engine. The first runs at 164 revolutions and drives from a countershaft the new monocyclic generator and two Thomson-Houston 75 light arc dynamos; the latter runs at 285 revolutions and drives a Thomson-Houston bipolar direct current low voltage machine. Fig. 2 shows the arrangement of the machinery. The monocyclic generator is a standard 12-pole generator, running at 600 revolutions. It is rated at 150 kilowatts at 1,040 volts, and is excited by a 1½ kilowatt exciter. The direct current dynamo furnishes current for motors scattered throughout the city. The arc machines operate lights in the streets, while the monocyclic is wired for about 280 horse power in motors and 2,000 lights. If all the lights and motors were operated at the same time the total amount of energy required from this generator would be about double its capacity, and its power to cope with the conditions illustrates forcibly the advantages of the monocyclic system. During the day the lights burning are comparatively few, while the motor load is at its maximum. This condition is reversed after dark, when the motor load drops off and the lighting load rises in turn. The generator, which runs 23 hours per day, is worked continuously at its highest efficiency and satisfactorily fulfills its double duty without sparking or noticeable heating.

The regulation of the machine is noteworthy, the voltage remaining almost absolutely constant. The lights at a large factory about a mile away and those throughout the city burn with equal brilliancy, and the throwing on or off of the motor load is accomplished without flickering or variation of the intensity of the light. The regulation is attained by placing the stationary shunt of the alternator in a certain position in the morning, and leaving it thus during the day, while the induction motor load dominates. At night, when the lighting load is the heavier, the only change necessary is the advancing of



CONTROLLING STAND AT THE HAYMARKET THEATER.

the stationary shunt about one inch. No care beyond this is needed to maintain a constant potential.

The most important client of the Middletown station is the Miami Cycle & Manufacturing company, whose factory is located about one mile distant. It takes current for 180 horse power in motors, for 800 incandescent lamps, of which 400 are usually in use, and for six arc lamps. The cycle company turns out about 200 wheels a day, and employs from 500 to 600 hands.

Fig. 1. Generating Station.

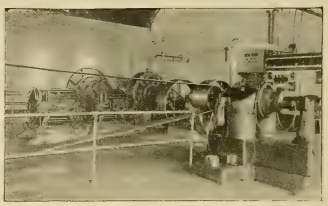


Fig. 2. Interior of Generating Station.

Fig. 3. Corner of Machine Room in Bicycle Factory Showing Induction Motors.

Fig. 4. Part of Bicycle Assembling Room Showing Motor for Elevator.

USE OF ELECTRIC POWER IN MIDDLETOWN, O.

The current is transmitted from the station to the works over two mains and a teaser wire at about 1,000 volts, and is reduced to about 115 volts in six 30,000 watt oil-cooled transformers installed in a small house erected in the angle of the L-shaped main building. All the motors derive their supply of current from these transformers connected in multiple. The lighting circuits are taken off from two 7,500 and one 15,000 watt transformer. The primary wires from the station are passed through a station wattmeter just before they arrive at the transformers, and thus the consumption of energy in both lighting and motor circuits is measured in one instrument.

The secondaries run from the small sub-station north and south to the motors and lights in the two legs of the L. Those running south operate in the machine shop three 20 horse power motors (Fig. 3), each belted to a long line of shafting from which run 80 belts. One of these motors is used to drive 15 lathes, four sharpers and six milling machines, three water emery wheels, one planer, one die sinker, two universal grinders, two gear cutters, and two drill binders. The other two operate 35 screw machines, one oil separator, one oil pump and two high pressure blowers giving air to the forges in the smithy.

The feeders running north supply energy to three 30 horse power motors, two of 10 horse power and two of five horse power. One of the 10 horse power motors is in the drill room and runs a shaft from which belts run to 12 large and three small drill presses, two cone grinders and four small milling machines. In addition it operates one band saw, one circular saw and one wood turner's lathe in the pattern room adjoining. The other 10 horse power motor is in the frame-making department and drives three large punch presses for the manufacture of handle bars, seat posts, etc., three large drill presses, four small ones, two frame assembling tables, three small milling machines, two emery grinders, one swaging machine, four stock machines, two tooth cutters and one double polishing lathe.

A large portion of the power which comes into the factory is used in the polishing room, where 35 double polishing lathes run incessantly. These are operated at present by two 30 horse power motors. The remaining 30 horse power motor in the north section drives a 48-inch exhaust blower which carries away the dust from the polishing room.

Located in the assembling department is a five horse power motor (Fig. 4), which operates a freight elevator of 1,500 pounds at 60 feet per minute capacity, which runs up and down through the room. When this was put up it was thought that a larger motor would be required to move up and down the occasional heavy loads, but the five horse power motor not only operates the elevator satisfactorily, but also has sufficient power left to drive five small drill presses. Another five horse power motor drives a four kilowatt C & C generator used for plating purposes.

All these motors are of the General Electric induction

type, without commutator, collector or moving contacts They are set upon platforms swung from rafters in the rooms, an arrangement rendered possible by the fact that they require no attention beyond an occasional oiling, and thus occupy no floor space whatsoever.

In addition to the load at the Miami cycle works, the monocycle generator supplies current for 500 to 600 lights throughout the town and 650 incandescents in the Sorg Opera House. With 50 horse power in motors and 400 lamps burning at the cycle works, and as many in the city, the lights in the opera house burn brightly and without flickering.

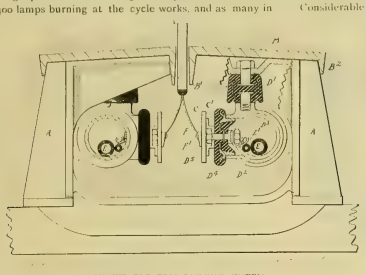


FIG. 1. K. A. K. CONDUIT ELECTRIC RAILWAY SYSTEM

## Controlling Stand at the Haymarket Theater.

Constant improvements are being made in electric lighting apparatus for theatrical use, until now the most exact control and delicate graduation and regulation are possible. With facilities for controlling the light to a nicety, one of the old-time objections to the use of the electric light for stage effects is removed; as for the electric light itself, it has been for years in great favor for theatrical use, owing to its safety and superior quality. The illustration (page 200) shows the completely equipped electric light controlling stand in the Haymarket Theater, Chicago, as installed by the Washington Electric company. This stand consists, essentially, of a switchboard and 13 Meissner stage dimmers. The controlling levers are all easily within the reach of the operator and are so arranged that they can all be thrown at once, or singly, if desired. The only extra wiring for the combination is the circuit for each dimmer, leading from the switch to the binding-posts. This stand has been in operation for two years, and it fulfills every requirement. It is interesting to note that the photograph from which the illustration was made was taken by the aid of a Meissner focusing arc lamp, also manufactured by the Washington Electric company.

## K. A. K. Conduit Electric Railway System.

Considerable importance is to be attached to the new K. A. K. electric railway system, which does away with overhead wires and which has excited much attention in the West. This system is the invention of A. S. Krotz of Springfield, O., and W. P. Allen of Chicago and is owned by Krotz, Allen & Kelly of Springfield, O., whose surname initials give it the trade name adopted. A trolley conduit system is provided, modified for adaptation to existing steam roads, elevated roads or ordinary street railway lines. A line of railway equipped with this system is now in operation in Springfield, O.

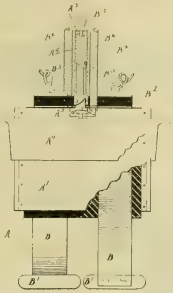


FIG. 2. K. A. K. CONDUIT ELECTRIC RAILWAY SYSTEM.

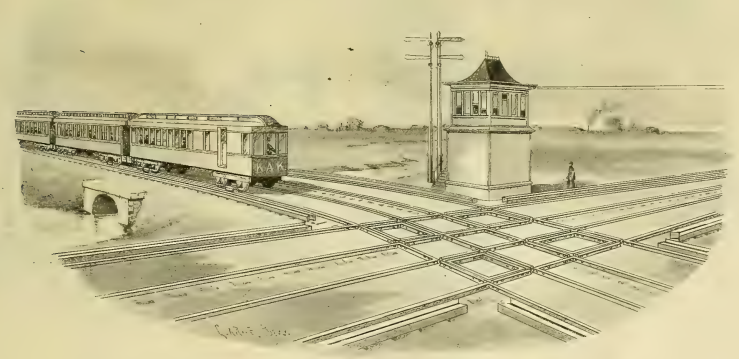


FIG. 4. K. A. K. CONDUIT ELECTRIC RAILWAY SYSTEM

In Fig. 1 is shown the type of conduit designed for city streets. It is intended to rest on the ties in the middle of the track, the top being flush with the top of the rails, which are supported on ties or chairs in the usual manner. The yokes and castings are made especially heavy to withstand the wear on a street pavement. Referring to the diagram, *A A* is the supporting yoke, $D^3$ ordinary gas pipe 1½ to three inches diameter, supported by insulators $D^5$. In this gas pipe is placed the feeders *E*, which extend the entire length of the track, and connected to these at suitable distances, by means of switches and fuses enclosed in water-tight boxes, are auxiliary feeders $E^1$, each of sufficient size to carry the current for feeding independent sections of the rails *C* of the same length. This admits the cutting out of any section of rails *C*, either automatically for cause or when necessary for inspection, without interfering with the operation of the line. Contact between supplementary feeders $E^1$ and rails *C* is made every 24 feet by the bolts $D^7$, which passes through the insulators $D^6$ which enter the pipe through the *T* couplings $D^2$. The insulators for supporting the pipe and the rails on the pipe are large and especially designed for the purpose. The contact rail *C* is of steel, presenting a wide surface for contact with the trolley shoe. It will be seen that for any of the current to escape it must pass through a quadruple insulation; i. e., the insulation enclosing the feeders, and the insulators supporting the gas pipe, which enclose the feeders on the positive side, also through a like insulation on the negative side. In the application of the K. A. K. system to street railways, there are manholes every 300 or 500 feet, where the sections end and the switches and fuse boxes are placed, and where connection is made with the sewer. The top of the conduit *B* can readily be removed at any point along the line by trackmen, and inspection can easily be made without danger to the workmen.

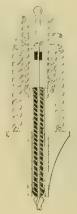
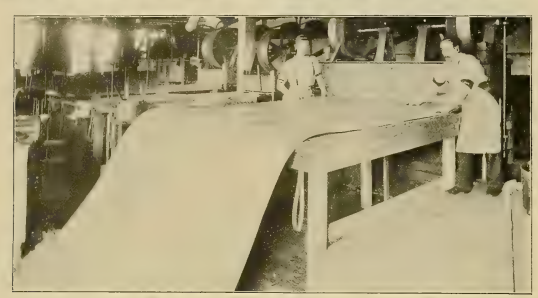


FIG. 3. K. A. K. CONDUIT ELECTRIC RAILWAY SYSTEM

Details of trolley construction are shown in Figs. 2 and 3. *B B* show two springs made of flat steel or spring brass. On their lower ends are attached cast-iron shoes $B^1$ $B^1$, for making contact with the conductor rails *C*, as shown in Fig. 1; these shoes can readily be replaced at a trifling expense. The springs *B B*, one for positive and the other negative, are curved in opposite directions at the bottom and pass through and are

supported in insulating material $A$, which is in turn protected and supported by the steel covering $A^1$, which, again, is fitted loosely in base $A^2$ fastened permanently to the trucks. Springs $B$ and $B_1$ which are fastened together at the top by the insulating fiber strip $B^2$, pass loosely through the insulation $A$, of casing $A^1$, and are held down by the springs $B^3$, which are attached to the post and cross bar, $B^4$, $B^5$ and $A^3$. The casing, $A^1$, is in turn held down by heavier springs, $A^4$, attached to the standard, $A^5$, and the base, $A^6$. Binding posts are provided at the upper ends of springs, $B$ $B_1$ to which the wires, $B^6$, leading to the motors are attached. To-raise



A MONSTER BELT

the trolley from the slot, a lever on the car platforms attached in a proper manner to the cross-bar, $B^5$, is provided, by which a single pull by the motorman first raises the springs $B$ $B_1$ drawing the shoes away from the rail, $C$ (Fig. 1), and together at the bottom of the casing, $A^1$, as shown in Fig. 3, and raising the casing, $A^1$, and themselves from the slot.

The method adopted at railroad crossings is shown in Fig. 4. The conductor rails, $C$ (Fig. 1), are placed on a line above the level of the track rails. Thus, by continuing the conduit up to the crossing, then discontinuing it and depressing the pipes so that they pass under the crossing or street, then resuming the usual position in the conduit on the other side, the trolley shoes pass over the top of the street or track rails, and enter the conduit on the other side; thus is avoided all cutting of track rails at crossings or switches, or the placing of obstructions at street crossings. It will be observed that, in a train, each truck of all the cars is provided with a trolley, and these are all electrically connected with the motor or motors on the train and controlled by the motorman on the front of the train, and while some are out of the conduit while passing over a street or railway crossing, the remainder supply the circuit without a break.

## Affairs of Queen & Co.

At the Manufacturers' club in Philadelphia, on the evening of April 16th, the creditors of the house of Queen & Co., manufacturers and importers of scientific instruments, which went into the hands of an assignee in August, 1894, met, and, after thanking John Gordon Gray for his work in paying them every dollar due them, presented him a magnificent set of the Encyclopedia Britannica. It was a representative assemblage of business and professional men, and the praise heaped on Mr Gray was unstinted.

The meeting was called to order by A. G. Elliott, who briefly told its purpose and made the presentation of the set of books. Mr. Gray responded in an eloquent address. He thanked them all for their patience in the past, and assured them that but for their forbearance such a result as they were celebrating could never have been achieved. He said that when the troubles overtook the firm the assets were twice the liabilities, which were laced at $184,000. But the appraisers of the court, who reckoned on what the goods would bring at a forced sale, set their value at one-half the assets. In the face of these difficulties the debts were paid and the receivership will soon end, and the firm of Queen & Co. will receive nearly $200,000 in assets and a business constantly growing.

Mr. Gray has been connected with James W. Queen & Co. and Queen & Co. since 1882. In the reorganization of the company Mr. Gray assumes the presidency, while S. L. Fox, who formed a partnership with Mr. Queen in 1858 and who was the senior partner from 1870 until 1893, is the new vice-president. J. M. Hazel is secretary and treasurer.

## A Monster Belt.

What is confidently stated to be the largest belt ever constructed is shown in process of manufacture at the Chicago Belting company's works by the illustration. The dimensions of the completed belt are as follows; Length, 150 feet; width, seven feet; weight, 3,300 pounds; thickness, seven-eighths of an inch. In its construction the selected portions of 450 oak-tanned hides, picked from over 5,000 skins, were used. The destination of this belt is the engine room of the Louisiana Electric Light company at New Orleans, where it will be attached to the 28 foot driving wheel of the great Allis-Corliss engine. To remove the roll from the finishing-room on the top story of the factory was by no means easy. Special tackle had to be rigged to the freight elevator and the bulky mass lowered onto trucks.

Not the least interesting detail connected with the building of this great belt is the method by which layers of skins were arranged so that at every point from end to end there is not a spot where at least two solid thicknesses of leather do not cover the spliced section of the third layer. Thus the beginning of the lowest layer is made up in three pieces, 21, 42 and 21 inches wide respectively, above these come two pieces of 42 inches wide each, and the third or topmost layer is made up of three oblongs 28 inches wide. In this manner no two seams fall together, but, on the contrary, every joining is strengthened by two solid thicknesses. The whole mass of the belt was subjected, section by section, to a pressure of 220 tons, after piecing and glueing, before the belt was finally completed.

## New Core Disk Notching Press.

A new press for notching armature core disks is shown by the accompanying illustrations. In principle and design the machine is entirely different from others directed to the same purpose, and in a number of important features presents advantages.

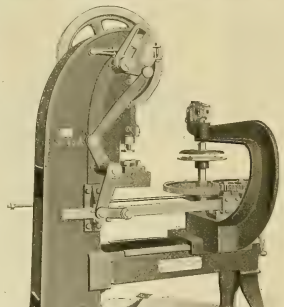
The adjustment for different diameters is made by simply turning the hand-wheel shown. No alteration or readjustment of pawls or indexing parts to suit different diameters is required. The adjustment for different numbers of notches is effected by means of change-gears instead of the usual pawl and index plate device. One gear only need be substituted to obtain any desired alteration in the number of notches. This obviates the necessity of using a special indexing-plate for each style of disk, and effects a considerable saving, as the change-gears are comparatively inexpensive. If one notch is punched at each stroke, the number of teeth in the gear corresponds to the number of notches in the disk. If two or three notches are punched simultaneously, the number of teeth in the gear is made one-half or one-third, respectively, of the number of notches.

The index-feed is effected by means of a rack-and-pinion movement, which is more reliable and durable than the pawl-and-rachet feed usually employed and does not call for any adjustment for different diameters or numbers of notches.

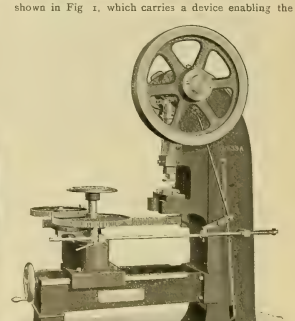
An automatic stop is provided, which throws out the clutch (thereby stopping the machine), as soon as the disk has made one complete rotation. To start the machine the operator depresses the foot-treadle, after which he can attend to any other machines that may be under his charge, as the work goes on automatically and stops when the last notch is cut. This makes it possible for one operator to attend to several machines.

A spring stripper is used in connection with the punches in this machine, so as to leave a clear space over the die, making it easier to introduce a new disk, and holding the disk under pressure while being punched. This obviates the necessity of using a clamping-plate over the center of the disk, so that the time is saved which in other machines has to be spent in clamping and unclamping the disk. Such disks as have no key-notches or bolt-holes, by which to carry the disk in feeding, of course require the clamping-frame.

In the few cases where the clamping of the disk is desirable the machines are furnished with an arm, as shown in Fig 1, which carries a device enabling the operator by a single movement of the hand lever to do the clamping. This arm connects at its lower end with the frame, carrying the mechanism for revolving the disk from notch to notch. The upper clamping-plate, instead of having to be taken off and put on by hand, as in machines of older design, is always ready for action without handling. The press is shown without the clamping arm in Fig. 2.



With Clamping Arm, Showing Rack and Pinion Mechanism.



Without Clamping Arm, Showing Automatic Stop.

FIGS. 1 AND 2 NEW CORE DISK NOTCHING PRESS.

These machines are the product of the well-known press and die maker, the E. W. Bliss company, 14 John street, Brooklyn, N. Y. They are regularly made in two sizes No. 16A and No 19A weighing respectively about 1,500 and 2,800 pounds. No 16A will notch disks of

from three to 36 inches in diameter; No. 39A will take disks of from five to 48 inches. The smaller machine will make from 100 to 200 strokes per minute, according to the work being done, and the larger may be run at about 100 strokes per minute. For very large disks No. 39A is specially made with extra large clamping and indexing frame. So constructed it will take disks of from 10 to 60 inches.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, April 18. -An interesting commentary on the electric lighting situation in Brooklyn has been brought out in the shape of a letter in the *Tribune* from Mr. Doty, the president of the Edison Electric Illuminating company of Brooklyn. On Monday the *Tribune* printed an article about the reported prospective contest between the Edison company and the new State Electric Light & Power campany, under the heading "A Pretty Fight Coming—The Profits of Electric Lighting Plants in Danger." In this article it was stated that the city paid 50 cents a lamp per night for 1,200 candle power lights. Mr. Doty promptly wrote to deny this—giving the correct price, 35 cents—and incidentally he gave the public the benefit of some of his ideas on the central station business. An extract from the letter will be of interest:

The Edison company received its franchise in 1888 and immediately proceeded to lay its underground tubes through the streets. It was actively opposed by the existing companies, but competed with them, and forced its way to the front. For various reasons it never bid for the street lighting until the advent of the Schieren administration, its bid then being a liberal reduction from the prevailing rates. Its service was so satisfactory that it received the contract for the next year, and subsequently, as you state, absorbed the Citizens' company, buying and paying cash for the entire stock of that company. This step had been found necessary because the profits of electric lighting were diminishing and required the most careful management of expenses to meet the reduced rates and still afford any dividends to the stockholders.

The time is past when electric companies can be built upon wind. It requires a distinct outlay of cash—and of a great amount of cash—to establish successful companies. So far from there being large profits in electric lighting, it has become a matter of sharp competition, quite as sharp as in most other businesses. Statements are carelessly made frequently, and generally by parties who are not conversant with the business, that there are large profits in street lighting. It is doubtful if these parties have any conception of the magnitude of the plants, of the details of the business, or even of the amount of taxes which these companies have to pay to the city and state, as part of their expenses. The equipment which would be ample for a country town or even a small city would not be permitted by the authorities in this city.

The distinguished sea captain who can furnish lights at 12½ cents per lamp per night can have a first-class salary if he will apply to this company and give us the benefit of his knowledge and services; but this situation has been open for years to the best experts in the country, and we are still unable to find any better system than that we use. W. F. O.

## PERSONAL.

Ralph W. Gordon of the Gordon-Burnham Battery company of 82 West Broadway, New York, is in Chicago for a few days.

A complimentary notice of the work of Orrin E. Dunlap of Niagara Falls, who has for some time been a contributor to the WESTERN ELECTRICIAN, appeared in the March number of *Cassier's Magazine*.

John F. Outwater, representing Hugo Reisinger, 38 Beaver street, New York, sole importer of the Nürnberg "Electra" carbons, was in Chicago last week. Mr. Outwater expects to return to New York in time to attend the convention of the National Electric Light association

A. L. Tucker has succeeded E. M Scribner as manager of the supply department of the Western Electric company. Mr Tucker has been connected with the Western Electric company for over 10 years and is admirably adapted to fill the onerous duties of his present position Few men are better acquainted with the endless details of electric supplies than he, and the Western Electric company is to be congratulated in having such a valuable man for its supply department.

## TRADE NEWS.

Eugene Munsell & Co. of New York announce to the trade that they have opened a branch house at 153 Lake street, Chicago, to accommodate their constantly increasing western trade. Their well-known mica goods were formerly sold through W. H. Sills & Co , formerly the Chicago sales agents. The new establishment will be in charge of Charles E. Coleman, who has been with his company for over seven years. Mr. Coleman is well known to the electrical fraternity, and is well fitted for the responsible position which he has assumed. The Munsell company is to be congratulated in having so reliable a man to place in charge of this important branch of its business.

The W. S. Hill Electric company of Boston, Mass., has reorganized as a new corporation under the laws of the state of Massachusetts, with a fully paid-up capital stock of $60,000. The business of the new company will be moved to New Bedford, Mass., about May 1st. It will be carried on in a large factory building, which will be equipped with a 50 horse power engine and boilers of ample capacity to meet future growth of business, together with new machinery and all facilities required to enable the company to manufacture its goods to the best possible advantage and maintain the present high standing of the Hill electrical goods. W. S. Hill is one of the pioneers in the electrical trade, and enjoys the confidence of the fraternity east and west by reason of the high grade of apparatus which has become associated with his name. His numerous friends will join in wishing him continuation of his business success. It is understood that the W. S. Hill Electric company will continue to maintain an office in Boston, with agencies in the leading cities of the country.

Few among the younger electrical business men of the great West and Southwest have achieved what might be termed a more "solid" success than President Joseph Franklin, Jr., of the Commercial Electrical Supply company of St. Louis. Mr. Franklin is one of those men whose personality has great weight in attracting customers. The recent increase of the company's capital stock tells its own story and is a strong tribute to the ability of one of the younger men in the trade. From now on the company's aggressive policy will be continued more energetically than before. Mr. Franklin's methods are in many instances unique. "Make people talk about you and your goods" is his motto. He believes that original methods in advertising best carry this out. "Jo's slate" from now on tells its little story in its own peculiar but nevertheless strikingly original manner. As a western supply house the Commercial company believes in thoroughly advertising its goods, and many the line there'll be that will find its own curious picture drawn by special artist on "Jo's little slate."

The Lafayette Engineering & Electric Works of Lafayette, Ind., has entered the electrical manufacturing field with every prospect of success and permanence. It makes dynamos, motors, arc lamps and electrical specialties, and its fine new catalogue shows that it is getting out a line of goods that will compare very favorably indeed with the best in the market. Simplicity and uniformity of manufacture have been successfully essayed, and only the best workmanship and material are employed. All parts are made to gauge and interchangeable. The company offers bipolar dynamos, each having a single field coil, and slow-speed multipolar machines also. The latter type is especially well adapted for direct connection. In arc lamps, both series and constant potential lamps are presented, and the company also has a complete line of motors, rheostats and switchboards. A beautifully printed catalogue, just out, describes the company's apparatus and also gives much general information of value to the electrical reader The goods of the Lafayette company are handled by the Mason Electric Equipment company, 307 Dearborn street, Chicago, which is the selling agent

Very few people outside of a certain line of business are aware of the destiny of copper wire after it has been discarded As the electrical business has been growing very rapidly in the last few years, there has been more and more old copper wire accumulated at the different electrical stations and electric railways throughout the country. One company in particular, located in Chicago, has been making a specialty of buying this old wire, and has been very successful in getting a large portion of such discarded trolley wire and other scrap wire It has men who understand the quality of the different grades of wire and assort them If the wire is still in good condition, it is resold for use If not, it is usually put in crucible shape and made into ingots and is used generally by brass foundries throughout the country At times this house accumulates more than it can dispose of at home, and the metal is then exported to Germany and other countries. This concern is the Swarts Metal Refining company, 120 and 122 West Lake street, which also makes a specialty of manufacturing a high grade of dynamo and engine babbitt, with solder and cotton waste for electrical plants and railways.

The Standard Underground Cable company has recently made a number of important changes in the personnel of its home office at Pittsburg. P. H. W. Smith, who was formerly superintendent of construction for the western sales department of the company and more recently assistant to J. W. Marsh, vice-president and general manager, has now been appointed assistant general manager of the company. Mr. Smith's training in electrical matters was received at Lehigh University, of which he is a graduate. He has been actively connected with the Standard Underground Cable company for a number of years in the construction and sales departments, and the advancement is well merited. F. S. Viele, formerly of the Buffalo Railway company, but for several years past superintendent of construction for the western sales department, and temporarily in charge of the latter, has been transferred to Pittsburg as manager of the conduit and general construction departments. In addition to the general construction work, Mr. Viele will have under his immediate charge and supervision the conduit sales department and rubber sales department. Mr. Viele is a graduate of the Massachusetts Institute of Technology in electrical engineering, and his recognized ability as a trained expert in matters pertaining to insulated wires and cables makes him a valuable man to the company.

## BUSINESS.

The electrical public is appreciating the good points of the Garton-Daniels lighting arrester more and more It is stated that the sales of this instrument during March of this year were twice as large as those of March, 1895.

A new branch house has just been opened by the Mica Insulator company of New York at 153 Lake street, Chicago, to accommodate its largely increased western trade. This branch will be under the management of Chas. E. Coleman, who has made an excellent reputation among the electrical fraternity through his seven years' connection with his company. Mr. Coleman will give all orders for micanite specialties his personal attention, and it is expected that under Mr. Coleman's careful management the sales for his goods in the West will largely increase in amount.

The Electrose Manufacturing company, manufacturer of telephone parts and electrical insulation, now situated at 216 William street, New York, owing to the constantly increasing demand for its wares, is again compelled to seek larger quarters, and will remove on May 1st to 127-137 North Tenth street, Brooklyn, N. Y. It will have there some 13,000 square feet of floor space, and with a largely increased plant it will be in a position to promptly meet all demands for its most successful substitute for hard rubber. The New York office will be located at 190 and 192 West Broadway, corner Leonard street, and will be in charge of Joseph Steinberger.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued April 14, 1896.*

558,027. Armature Winding. Asa F. Batchelder, Schenectady, N. Y. Application filed January 25, 1896.

A cloth is formed of insulated conductors with diagonally cut ends, and folded to form a wrapper designed to be applied to an armature core, and when so applied to form one or more complete wraps with abutting edges.

558,028. Signaling System for Electric Railways. Fred Bathurst, Schenectady, N. Y. Application filed July 15, 1893.

Block and signal lights are situated at the ends of a section of track, one set of signal lights indicating at all times the direction of the last car, and switches for closing the circuits of all lamps when a car is on the section.

558,031. Safety Device for Alternating Systems. Ernst J. Berg, Schenectady, N. Y. Application filed October 5, 1895.

The inventor claims in an alternating current electric railway polyphase supply lines, a motor actuated thereby having some of its terminals connected to the supply lines, and some to ground, inductance and resistance arranged in a normally disconnected auxiliary circuit, and switching mechanism for connecting the inductance and resistance between one of the lines and the ground, and connecting a terminal of the motor between the inductance and resistance.

558,033. Electric Railway System. Henry M. Brinckerhoff, Chicago, Ill. Application filed June 13, 1895.

Provision is made in an electric railway system, wherein are employed two or more independent sections of road, and an independent working conductor for each section, and as a means for bridging the space between the meeting ends of working conductors for successive sections of road for an auxiliary conductor at least equal in length to the distance between contacts carried on opposite sides of a car, and means for supplying the auxiliary conductor with current.

558,042. Automatic Telegraph Repeater. Albert E. Collyer, Monmouth, Ill. Application filed December 26, 1893

A rotatably mounted stem, a bar pivoted to the stem so as to rock, a circuit which the bar opens and closes in rocking, and an electro-magnet for rocking the bar when it is turned to one position are provided.

558,045. Method of Aging Permanent Magnets. Frank P. Cox, Lynn, Mass. Application filed February 21, 1896.

The method consists in reducing the flux in the magnet and causing the flux remaining therein to be permanent by cutting the lines of force in the magnet through the revolution of an electrical conductor in the field of the magnet.

558,051. Electric Trap Release James A. R. Elliott, Kansas City, Mo. Application filed July 11, 1895

An electrical release for live-bird or inanimate target traps is described, comprising a suitable casing, a notched disk rotatably mounted therein and projecting through a slot in the casing, a pin projecting from the disk, a stop plate held yieldingly in the path of the pin, and an arm upon the casing notched to form an overhanging shoulder which overlaps the notch in the disk.

558,052. Apparatus for Electrolytic Production of Zinc. Robert Encke and Oscar Frölich, Berlin, Germany. Application filed July 31, 1895.

Partition plates are arranged substantially vertical in the cell, spaces being left above and below the plates for the passage of the electrolyte, and means are provided for circulating the electrolyte at a high velocity around the plates and over the electrodes.

558,070. Compound Mold for Forming Incandescent Lamp Bases. Jacob Henny and August Pederquist, Schenectady, N. Y. Application filed November 29, 1895.

The inventors claim the combination with a lower die having pins, of an upper die formed with cavities and projections on one end, and vertical side grooves to form projections and cavities of the insulating base, and perforations in the end of the die to receive pins projecting from the lower die

558,090. Transformer and Method of Cooling Same. Walter S. Moody, Lynn, Mass. Application filed January 17, 1896.

Coils of wire are surrounded by an iron core, and an insulating medium flows down the outside of the core in a film.

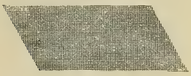
558,091. Battery William Morison, Montclair, N J Application filed May 8, 1894.

A pivoted battery provided with a movable joint attachment as a swivel joint, in combination with a support constructed and arranged to engage therewith, and consisting of two detachable members, and also with locking means constructed and arranged to rigidly fasten together the members when the battery is in one position.

558,104. Regulating Induction Motors. William B. Potter, Schenectady, N. Y. Application filed January 15, 1896.

The method of regulating alternating current motors of the induction type consists in connecting the fields permanently in multiple between the supply lines, closing the circuits of the armatures through separate simultaneously variable resistances, and varying the resistances to regulate the speed of the motors.

558,106. Connection for Telephone Apparatus. Parnell Rabbidge, Sydney, New South Wales. Application filed May 20, 1895.



NO. 558,027.

A telephone apparatus is described, comprising two conductors, one of which is permanent, the transmitters and receivers arranged in the closed circuit formed by the permanent conductor, the other conductor being arranged in shunt with the receiver and transmitter, and arranged to be broken, the receivers being arranged to make and break the shunt circuit, the call-bells in the shunt conductors and the pole changers in the permanent circuit.

558,109. Automatic Cut-out and Resistance Regulator. Emil B. W. Reichel, Gross-Lichterfelde, Germany. Application filed December 27, 1895.

Features of this invention are a pair of contacts, between which an arc is adapted to be formed upon the separation of the contacts, an electric circuit to be controlled, in which circuit the contacts are included in series, a solenoid or electro magnetic coil included in the circuit responsive to changes of current strength therein, and arranged to separate the contacts to a greater or less extent to introduce a resistance into the circuit proportional to the current strength, and means for permanently separating the contacts upon the passage of a current of a predetermined maximum value to permanently open the circuit, whereby variations of current strength below the predetermined maximum are compensated for by the introduction of an arc resistance while the circuit is permanently opened when the current strength exceeds the predetermined maximum.

558,110 Electric Railway. Lemin W. Reid, Mound, Tex. Application filed August 8, 1895.

A rod is pivoted to a block beneath the car, with a collar slidable on the lower end of the rod, a guide wheel journaled to arms of the collar, an arm attached to the side of the collar, a trolley wheel on the arm, a spring-pressed collar bearing against the trolley wheel, a feed-wire attached to and insulated from the top of the conduit, a rail forming one wall of the conduit, a foundation for the rail extending within the conduit, and having a slot forming a way for the guide wheel, and means for draining the slot.

558,119. Regulating Alternating Current Motors. Charles P. Steinmetz and Ernst J. Berg, Schenectady, N. Y. Application filed December 26, 1895.

Features of the invention are lines between which single-phase electromotive force is maintained, transformers having their primaries connected in series between such lines, and having a secondary in reversed relation to the remaining secondaries of the transformers, lines leading from the secondaries, and a multiphase motor connected to such lines.

558,120. Commutator. David P. Thomson and Alexis R. Goranson, Schenectady, N. Y. Application filed December 19, 1895.

This is an automatic ventilating commutator formed with an internal radial fan, and a circumferential air chamber, having air passages leading from the inside to the outside of the commutator, the air chamber and fan serving to maintain a forced circulation of air through the commutator.

558,122 Incandescent Lamp Konrad O E Trobach, Pankow, Germany Application filed April 18, 1894

An electric lamp comprising a bell shaped incandescing body of flexible and spongy carbon and circuit terminals connected therewith

558,151 Electric Railway System William M Brown, Johnstown, Pa Application filed November 29, 1895

A contact box for electric railways systems is described, comprising a body having a cavity containing mercury, and a conductor leading into the cavity, a body floating in the mercury and adapted to be magnetically influenced, a cover over the mercury composed of a center of non-magnetic material, and two sides each of material adapted to conduct magnetism.

558,153. Electrically Actuated Dental Plugger. Arthur W. Browne, Prince's Bay, N. Y. Application filed November 6, 1895

The first claim: The combination of the supporting frame, the electro-magnets, the pivoted armature hammer, [illegible] the plugger actuated by said hammer, the terminal contacts of the plugger circuit, the finger-actuated controller on the plugger handle, means to complete the plugger circuit controlled by said controller, and means to [illegible] the force of the blows of the armature hammer, also controlled by said hammer.

558,165. Electric Wire Cleat. Frederic B. Evans, Clinton, Mass. Application filed August 26, 1895.

A wiring cleat made in two similar and interchangeable parts, having interlocking faces substantially perpendicular to the base of the cleat and at right angles to the wire passages.

558,167. Telephone Service Register. Stephen D. Field, Stockbridge, Mass. Application filed August 21, 1895.

This register comprises a lever or device whose position is changed during the use of the telephone transmitter or receiver, register mechanism, actuating mechanism therefor, such as a spring and connections, and means operated during the transmission of a signal to bring the actuating mechanism into operative connection with the register mechanism.

558,168. Call Counter for Telephones. Stephen D. Field, Stockbridge, Mass. Application filed August 21, 1895.

A lever controlled by a telephone switch, a retractive spring acting thereon, retarded driven mechanism and a train of counter-wheels actuated by the driven mechanism, a key controlling the circuit of a calling generator, and link mechanism actuated by the key to connect the lever with the driven mechanism.

558,176. Process of Electrizing Water for Heating Purposes. Philipp Huber, Saginaw, Mich. Application filed April 1, 1895.

Apparatus is employed for the manufacture of hydrogen and oxygen gases from water by the electrization thereof, and for separating the gases and storing them, and tubes are provided for conveying the gases in separate pipes to a burner, the tube conveying the oxygen gas passing through the face of the burner at the middle thereof and terminating just in front of the burner. and the tube conveying the hydrogen gas having the burner formed upon the end thereof, the burner being circular in form and provided with small holes on its front face through which the hydrogen passes, and means in front of the burner for receiving and radiating the heat, and means for regulating the supply of gas to the burner.

558,184. Carbon Brush Holder for Electric Machines William E. Knowlton, Portland, Me. Application filed February 19, 1896.

The device consists of a socket for holding the brush on end against the commutator, a clamp secured to the brush holder stud, bars or rods connecting the socket with the clamp, and a spring pivoted by one end to the clamp, the opposite end bearing on the outer end of the brush to press the same against the commutator.

558,238 Electric Railway. Harry L. Tyler, Corning, N Y. Application filed July 11, 1894.

A system of alternating current electric locomotion comprising a working circuit composed of track rails, a plurality of transformers connected in multiple arc with the working circuit, and a primary inducing circuit charged with alternating currents of high potential and composed of an independent insulated outgoing conductor and a return leg formed by one side of the track or working circuit.

558,239. Alternating Current Motor. Harry L. Tyler, Corning, N. Y. Application filed July 19, 1894.

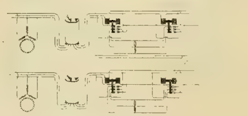
Claim is made in an electric transmission of power system of the combination of a source of supply of alternating currents, a circuit connected therewith, a synchronous electric motor, circuit connections whereby the non-synchronous motor brings the synchronous motor up to synchronism, a second coil on the armature of the non-synchronous motor and in inductive relation to the armature coil thereof, and means whereby the alternating current is switched into the synchronous motor and the second coil when synchronism is reached, thereby converting the non-synchronous motor into a revolving transformer.

558,252. Rheostat Plate. Joseph P Ball, Philadelphia, Pa. Application filed January 27, 1896.

A rheostat or resistance plate having grooves in combination with a resistance wire bent upon itself to form a convolute, and held in place within the grooves by compression against the walls thereof.

558,256. Electrically Operated Means for Controlling Valves. Charles M. Bush, Bristol, Conn. Application filed January 24, 1895.

A device is described comprising a magnet, having its pole faces arranged in a common plane and longitudinally of its field of force, an oscillatory armature adapted to move in and longitudinally of the field of the magnet, the armature projecting normally into the portion of the field of greatest intensity, and means for transmitting motion from the armature.



NO. 558,031.

558,283 Underground System for Electric Railways Alvaro S. Krotz, Springfield, Ohio, and William P. Allen, Chicago, Ill. Application filed August 23, 1895

In an underground system a series of sectional tubes or inclosing casings is provided, together with a conductor extending through all of the tubes or casings of the series, contacting devices supported on the tubes or casings, and a connection from the conductor to each of the contacting devices, the connections being made inside the tubes or casings.

558,284 Conduit or Subway for Electric Railways. Alvaro S. Krotz, Springfield, Ohio, and William P Allen, Chicago, Ill. Application filed December 2, 1895

In a subway or conduit a series of supports is connected to the walls of the subway or conduit by insulators, the supports being connected to and adapted to sustain contacting rails and feed wires or conductors, the contacting rails and feed wires or conductors being each insulated one from the other and from the supports, and a detachable connection from one or more of the feed wires or conductors to the contacting rails.

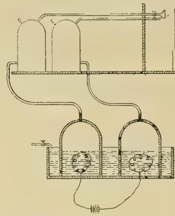
558,303. Electric Railway. David N. Osyor, Newark, Ohio. Application filed January 23, 1889.

The combination of the insulating posts, the conductors situated one above the other, formed with grooves opposing each other, the supplemental insulators and the bracket clips engaging with the outer faces of the rail.

558,310. Apparatus for Composite Transmission of Intelligence. Frank A. Pickernell, Newark, N. J. Application filed October 17, 1894.

A system for the simultaneous transmission of telegraphic and telephonic messages is described, in which the telephonic circuit is composed of the two main conductors with branch continuations through condensers at each terminal, and provided with receiving and transmitting telephonic apparatus; means are provided for preventing induced telegraphic currents from disturbing the telephonic signaling circuit, consisting of one or more ground branches from the circuit, with which are included alternatively electro-magnetic retardation coils or equivalent differentially wound signal instrument windings.

558,313. Telephone Transmitter. Allen W. Rose, New York, N. Y. Application filed August 29, 1895.



NO. 558,110.

The instrument comprises a diaphragm, electrodes, having a vibratory relation with each other, comminuted carbon mounted between the electrodes, and sloping flexible walls arranged at an angle to the direction of the vibration

558,322. Electric Railway. Carl F. P Stendebach, Leipsic, Germany Application filed March 7, 1895.

An electric railroad with underground conductor is described, composed of a pair of guard rails, a contact rail, a case cover, inner cylinder, a mercury seal at the bottom of such cylinder, an insulated contact pin and a contact within the cylinder, all being so constructed that contact is made between the underground conductor and the contact rail by a depression of the latter.

558,343. Electric Switch. Charles G. Bergquist, Chicago, Ill. Application filed June 25, 1895.

The inventor claims the combination of a body having a dovetailed groove and a flattened surface, a shaft mounted to turn in the body and projecting therefrom at right angles to the flattened surface, insulated contact points on the body, a switch-arm on the shaft to engage the contact points, a ratchet wheel on the shaft, and a spring having a shank to engage the dovetailed groove in the body and arranged to engage the teeth of the ratchet wheel.

558,354 Telephone Transmitter. William R. Cole, Detroit, Mich. Application filed May 15, 1894

A feature of the invention is a suspended oscillatory electro-magnet in the circuit of the transmitter and carrying the outer electrode.

558,357. Electrical Furnace. Michael R. Conley, Brooklyn, N. Y. Application filed September 25, 1895.

An electrical metallurgic furnace is described, comprising a vessel of a composition containing carbon, with integral arms of the same material on opposite parts of the vessel, and to which the terminals of an electric circuit may be connected.

558,362. Electric Rheostat. Francis H Doane, Newton, Mass. Application filed September 30, 1895

One claim is given: In a rheostat, the combination of a metallic holding-strip electrically connected with the external circuit, a plurality of graphite bars held by said strip, one or more electrical connections from each of said bars to suitable contact terminals, and a movable arm arranged to make contact with the said terminals successively, said arm being also connected with the external circuit.

558,385. Telephone Bell. Richard D. Harrigan, Leadville, Colo. Application filed November 5, 1895.

The invention comprises a gong, a hammer therefor, a main electric circuit for operating the hammer, an auxiliary circuit comprising a battery, wires connected with the main circuit wires and contact points, and a closer for the auxiliary circuit comprising a lever, having its members arranged substantially at right angles to each other, one of the members being provided with contact points to engage the contact points of the auxiliary circuit, and the other member adapted to be engaged by the hammer.

558,429. Trolley Attachment for Electric Cars. Robert Skeen, Madison, Ill Application filed September 9, 1895.

In combination with a trolley a mechanism is placed in an electric circuit with the trolley, and adapted to check the upward movement of the trolley when the latter is disengaged from the trolley wire.

558,450 Electric Mine Cage and Elevator Charles J. Cutler, Butte, Mont. Application filed June 26, 1895

In an electrically operated elevator, the combination is claimed with fixed vertical guides provided with toothed racks on opposite sides of a cage, an electric motor carried on the cage platform having pinions on the ends of its shaft engaging the racks on one side of the vertical guides, an auxiliary shaft journaled in the cage platform parallel with the motor shaft, also provided with pinions on its ends engaging the toothed racks on the other or opposite side of the vertical guides, intermeshing gearing mounted on the respective shafts, whereby both are made to operate in unison, and a trolley carried on the cage in contact with a conductor connected with an electrical source of supply

Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, MAY 2, 1896. No. 18

## Electrical and Mechanical Equipment of the Milwaukee City Hall.

In these days of widespread distrust of municipal servants, when the word "Alderman" prefixed to a man's name is so often regarded as a term of reproach rather than a title of distinction, it is indeed gratifying to encounter intelligence, thoroughness, honesty and economy in an enterprise conducted by a city government. Such an exception is to be seen in the recent building of the city hall in Milwaukee. This fine edifice is a great credit to the city which it ornaments. As will be seen by the excellent picture of it on this page, the structure is of stately and commanding architecture, utilizing to best advantage the unusual shape of the site; it is substantially and well built in every detail, and, what is especially praiseworthy, it was erected at a cost of a trifle less than 20 cents a cubic foot, including furniture. It is truly an imposing building, and it would be difficult to disprove the claim made for it—that it is the best and cheapest public building of its class in the United States. It is proper to say that the result is due almost entirely to the sagacity and good judgment of Messrs. Benzenberg, Schneider, Schuengel and Brockman, who constitute the Board of Public Works, and to H. C. Koch & Co., the architects.

As might be expected, this building is very completely equipped for light, heat and ventilation. Early in the planning Charles G. Armstrong, the Chicago consulting engineer, was employed to take entire charge of the electrical and mechanical features of the necessary plant, and upon his plans, specifications and superintendence the work hereinafter described was installed.

The boiler plant, illustrated in Fig. 2, is located in the northeastern portion of the basement. It consists of four horizontal steel tubular boilers 16 feet long and 66 inches in diameter, built and installed by H. Mooers & Co. of Milwaukee, who were the contractors for the steam heating. These boilers are connected to a 16 inch main steel header sectioned in the center with a 16 inch Chapman valve in such a manner that in case of a leak in either one of the boilers, one or the other pair can be cut off from the system. In addition to this there is run an auxiliary header six inches in diameter connected in a similar manner. The piping from these headers is in duplicate, so that it will be impossible to have any accident that will entirely cut off steam. The exhaust pipes run from each of the four engines to the condensing room, where two Prescott condensers are arranged to work singly or in multiple, condensing from one or all engines as may be desired. All steam supply pipes are provided with copper goosenecks. All pipes are supported by cast-iron columns resting upon the floor, and the piping is covered throughout with a double thickness of magnesia pipe covering. The furnaces are the well-known Hawley "down-draft" type (Fig. 2), which have proven to be so efficacious in connection with the city water works plant, and which in this case are daily burning seven tons of the cheapest grade of coal in a smokeless manner.

One of the first acts of the consulting engineer was to select the Paul vacuum system to connect to the 29,000 feet of heat radiating surface throughout the building, thus greatly enhancing the value of the radiators and also entirely removing the objection of back pressure on the engine. The result was that the engines operated throughout the entire cold weather with never to exceed one-half pound back pressure, and during most of the time at a a vacuum of one-half pound, when the condensers were not connected. This was accomplished by means of two Paul exhausters, neither of them occupying a greater space than six cubic inches. Automatic heat regulation is obtained by the Johnson pneumatic system, the thermostat in the various rooms operating directly on the air valves. The Johnson company also installed a clock system throughout the building and a large tower clock worked by its compressed air system and controlled by a master clock placed in the office of the Board of Public Works. In order to insure no interruption of the service a duplicate clock has also been provided.

FIG. 1. ELECTRICAL AND MECHANICAL EQUIPMENT OF THE MILWAUKEE CITY HALL.—EXTERIOR VIEW.

Ventilation is accomplished by means of a blower driven by an engine located in the basement, drawing air over temperating coils having 4,000 feet of radiating surface, all controlled by the Johnson system. This air is blown through galvanized iron ducts to the various offices throughout the building. There is also located in the attic a fan arranged to draw the foul air from the building and discharge it on the roof; this fan is operated by an electric motor furnished by the Gibbs Electric company of Milwaukee. The ventilating apparatus was supplied and installed by the National Blower company of Milwaukee.

The engine room is a fine apartment 32 by 35 feet in size, finished with red pressed brick. The floor is made of tiles laid in Portland cement mortar. Convenient tool cases are provided to hold engine tools, wrenches, etc. Views in this room are shown in Fig. 3. Here is the machinery installed by the principal electrical contractor for the building, the Western Electric company of Chicago, which, through its general superintendent, Edward Ellicott, secured the award for the engines, dynamos and electric wiring.

This plant is composed of four direct-connected multipolar dynamos, two of 105 kilowatts and two of 80 kilowatts each, wound for a maximum pressure of 120 volts, directly connected to four cross-compound Ball & Wood engines operating at 250 to 275 revolutions per minute. The cylinder dimensions of the larger engines are 14 by 22 by 12 inches, and of the smaller 11 by 18 by 11 inches. The dynamos were especially designed to meet the requirements of this plant. The armatures are ironclad, bar-wound and so connected that there is an air space between all wires, which are so arranged that no two wires cross anywhere on the armature. The commutators are extremely large, with carbon brushes which are required to carry only 25 amperes to the square inch of carbon when the machines are operating under an overload of 20 per cent. After a continual operation of 24 hours under full load, these machines did not rise in temperature more than 50 degrees Fahrenheit above the temperature of the surrounding air, whereas the contract permitted 80 degrees. The pole-pieces and frames are made of the best cast-steel and are made unusually large to insure a low heating limit. All finished parts of the machines are highly polished and lacquered and have a uniform copper finish. The connections to the switchboard are made by means of lead cables run underneath the floor in tile conduits.

The switchboard in this building is of an entirely new design. Not having space on the side walls, Mr. Armstrong conceived the idea of placing the board about the center column in the middle of the engine room. This design was carried out in a most excellent manner by the Western Electric company, making the board, as

shown from different points of view in Fig. 3, one of the handsomest features of the plant. Upon it are mounted Weston illuminated dial volt and ampere meters. The switches on this board are of the Western Electric quick-break pattern, excepting the two voltmeter switches, which are of the well-known Ellicott multiple type, so arranged that 12 different measurements can be made with the same switch, including measurements to ground from both poles. By means of these switches, which are simple in design but ornamental, knowing the resistance of the voltmeter, it is possible to make accurate ohmic measurements to ground. It will be seen by inspecting the pictures that the board is composed of vertical and horizontal marble slabs, the horizontal slabs forming a table about 18 inches deep. Underneath this table are the main switches and bus-bars. On the corners of the vertical column are the voltmeters, on swinging hangers. The dynamo switches, equalizer and rheostats are placed beneath the table, all being covered by a perforated circular metal cover. The equalizer and bus-bar connections are made at the four corners of the board underneath the shelf.

An interesting feature of this plant is the gauge-board shown in Fig. 4 (page 208), which was installed by the Ball & Wood company. It has two vacuum gauges, one for non-condensing and one for back pressure for the heating system, one altitude gauge to show the amount of water in the house tank and four steam gauges, one for each boiler. In addition, there are in the center two small gauges, one for the Paul vacuum system and the other for the Johnson regulating system. At the top is a clock. The gauges are finished in a uniform copper finish, which, on the white marble, makes a handsome appearance.

The current from the dynamos supplies about 5,000 incandescent lights and seven arc lamps—six of the latter of 2,000 candle power and one of 3,000. The arc lights are of the Western Electric constant potential type. Simplex braided caoutchouc wire is used throughout. The feeder connections are made at the top of the switchboard, the lead cables being placed in iron pipes running through the electroplated canopy at the top of the column, as shown in the center view in Fig. 3. These connections are made by large lugs to the polished bus-bars which run vertically on the face of the board.

All wire in this building is run in iron armored conduit manufactured especially for the plant by the Western Electric company. By an improved process this company has been able to manufacture a conduit in which the insulation adheres to the entire length of the iron pipe, making it impossible for the paper tube to become loosened or detached during the insertion of the wires. To protect the conduit a tile molding with three compartments—two for electric light wire and one for bell, district messenger and telephone wires—has been provided. This molding was designed by Mr. Armstrong especially for this building. It is made of terra cotta, fireproof in every particular, and has proved to be an excellent insulator. In order that the wire placed in these conduits shall be readily accessible a face-plate of cast metal beautifully ornamented and electroplated has been provided. This metal is made in sections of 36 inches in length, each length being lined with a sheet of fiber. Fig. 5 gives a view of this molding in a corridor. To show the wiring two sections of the face-plate were removed and will be seen leaning against the wall. This picture also gives an idea of the fixtures employed and shows one of the cut-out cabinets.

After the wires leave the cut-out cabinets they run to the molding and are then carried to a point opposite the outlets, from which point they are led to the various outlets in the building in the iron armored tubes described above. The cut-out cabinets are made entirely fireproof, the backs and sides being of marble; the doors are made of a special design of metal handsomely electroplated, each door being provided with lock and key. All hall lights are controlled by a special form of quick-break knife switch manufactured for use in the plant. All circuits are controlled by special fuses placed in these cabinets, each box being controlled by a main fuse.

The fixtures were designed by Mr. Armstrong and manufactured by the Cassidy & Son Manufacturing company of New York. An idea of the arrangement of lights about the central court may be gained by reference to Fig. 6. The building is wired with a complete intercommunicative set of private telephones, arranged so that the occupants of the various offices can converse with one another without using outside wires. A switchboard is placed in the fire alarm department to take care of the service.

## Historical and Popular Displays at the National Electrical Exposition.

So many important and interesting pieces of working scientific apparatus, illustrative of some electrical principle or employed in some investigation, have been placed at the disposal of the exposition management by universities, colleges and inventor, that special provision has been made for their expert care, so that they can, wherever possible, be seen in operation by the public. With this object in view, most of this interesting apparatus has now been massed into what will be known as "A Practical Laboratory," in which will be placed all pieces with which experiments or investigations of an educational nature will be made. This will enable the public to witness some striking phenomena, many of which have rarely been demonstrated hitherto outside of the walls of a college or private laboratory. In order to secure proper supervision for this laboratory, the Exposition company has asked Max Osterberg, of Columbia University, to act as its curator, and that gentleman has very kindly consented to serve. His familiarity with such apparatus and his skill as an experimenter promise a brilliant success for this novel department, which, it is said, has never been organized before at an exposition, but which realizes in a marked degree the educational purposes underlying the plans of the management. Mr. Osterberg is now laying out the plans for showing every piece of apparatus to its best advantage. His principal aim is to have everything in such condition that the public can be made to understand some of the most difficult points in electrical engineering within a few minutes. In that way the Electrical Laboratory becomes a directly educational feature, and if that end is achieved Mr. Osterberg will feel amply rewarded for the trouble and care bestowed on this exhibit. Professor Elihu Thomson is sending much apparatus which will be worked in this laboratory, and the entire working instruments of Cornell will be under Mr. Osterberg's care, in behalf of the university. Among the special attractions will be the material kindly furnished by Prof. R. Ogden Doremus, in behalf of the Bellevue Hospital, which represents also his personal work in connection with the College of the City of New York. Mr. Osterberg will arrange, by permission of Professor Crocker and Dr. Pupin of Columbia University, a set of coudensers to show the speed with which a message is sent through the transatlantic cables. A great many other attractive experiments are in store for curious visitors and inquiring students.

E. L. Morse, one of the members of the historical and loan exhibit committee, has prepared a remarkably interesting collection of early papers, models, relics, etc., relating to Morse, Vail, Henry O'Reilly, L. D. Gale and others, and to the early days of the telegraph. As the son of Professor S. F. B. Morse, he has, of course, exceptional facilities for the presentation of such matter, and the result of his efforts will be of great attraction to everybody. It is hoped that this collection will be supplemented by other material from other contributors. The list furnished by Mr. Morse is as follows:

1. Copy of the first wooden telegraph apparatus.
2. Certified copy of the Sully sketch book.
3. Original pen and pencil notes of Morse relating to the telegraph.
4. Letters of Alfred Vail relating to the telegraph.
5. Letter of Peter Cooper.
6. Letter of Cyrus Field.
7. Original 1843 contract of Alfred Vail with Professor Morse.
8. Piece of shore end of Atlantic cable.
9. Pocket telegraph instrument presented to Professor Morse by J. D. Caton.
10. Decorations and medals received by Professor Morse from European governments.
11. Marble bust of Professor Morse by Horatio Greenough.
12. Portrait of Professor Morse by Edward L. Morse.
13. Frame containing the following photographs: Birthplace of Professor Morse, in Charlestown, Mass.; church where Morse was baptized; residence, Poughkeepsie; residence, New York; University building, New York; Academy of Design copy of "Dying Hercules;" statue in Central Park; monument in Greenwood cemetery.
14. Letter of S. F. B. Morse written to his parents in 1799, when Morse was eight years old.
15. First picture painted by Morse, at the age of 15. A family group of his parents, his brothers and himself.
16. A few of Professor Morse's sketch books.
17. Daguerreotype of Professor Morse and his eldest daughter, taken by himself in 1840 or 1841; one of the first ever taken in America.
18. Letters from George Wood, Henry O'Reilly, Amos Kendall, Professor L. D. Gale, William W. Pell, Professor Benjamin Silliman and others.
19. Caveat for a mode of filling pipe with wire (MS.)
20. Miscellaneous papers, etc.

FIG. 2. ELECTRICAL AND MECHANICAL EQUIPMENT OF THE MILWAUKEE CITY HALL.—BOILER PLANT.

A. B. Chandler, president of the Postal Telegraph-cable company, has contributed an interesting frame of very early relics of the telegraph. It contains a piece of the wire used by Morse and Vail at the Vail Speedwell Iron Works; a piece of the tape that was indented with the signals transmitting the news of Henry Clay's nomination; a picture of the famous Speedwell shop—then and now—a portrait of Vail and some views of the early experimental apparatus.

E. J. Hall, Jr., vice-president and general manager of the American Telephone & Telegraph company, has loaned the exposition the original long-distance telephone set with which some years ago Professor Alexander Graham Bell opened the line between New York and Chicago. It has since that time been jealously guarded, and has had a silver plate put upon it bearing a suitable inscription. Mr. Hall accompanies this with a large picture, illustrative of the event, and with other material bearing upon the occasion. C. R. Truex has been entrusted with the care and arrangement of this interesting exhibit, which will be placed in the collection of the historical and loan exhibit committee.

Dr. E. L. Nichols of Cornell University furnishes the subjoined list of the valuable and important aparatus,

much of which is of historical as well as experimental interest, to be sent to the exposition. Professor Moler is to set it up there. As will be seen from the explanatory notes, the apparatus is such as permit of a repetition of some of the investigations at the exposition, where they will be greatly enjoyed, not only by the public, but by experts. The exhibit comes specifically from the Department of Physics and Electrical Engineering of Cornell University.

1. *Gramme machine* mounted upon Brackett cradle. It was constructed in the shops of Cornell University by Professor W. A. Anthony (summer of 1875), exhibited at the Centennial Exhibition (Philadelphia, 1876), and at the World's Fair (Chicago, 1893); capacity, five arc lights, each with 20 amperes. It was in almost constant service from 1875 to 1891, and is still in good order. It was the first machine of the Gramme type built in America. The cradle upon which it was mounted was one of the earliest examples of the Brackett dynamometer, and was designed and constructed especially for this dynamo. It reads in kilograms per revolution.

2. *Reversing switch.* For use with primary batteries. Designed and constructed by Professors Anthony and Moler for lecture room use, in 1875. (Original model.)

3. *A "doubler,"* or electrostatic accumulator, involving the principle of the electrophorus. Designed and constructed by Professors Anthony and Moler in 1878. (Original model.)

4. *Arc lamp for projection* (focusing). Designed by Professor Anthony, and constructed for him by the Brush Electric company in 1887. One of the early attempts to simplify the mechanism of direct current arc lamps. (Original model.)

5. *Small double coil tangent galvanometer.* Designed by Professor Anthony and constructed by Fred. C. Fowler in the workshops of the Department of Physics. It was intended for the absolute measurement of electromotive forces. (1884. Original.)

6. *Early form of alternating current dynamo,* for experimental purposes. Designed by D. C. Jackson and constructed by Fred. C. Fowler about 1885. (Original.)

7. *Swinging arm galvanometer.* Designed by Professor G. S. Moler and constructed by Fred. C. Fowler. (1888. First described American Institute of Electrical Engineers, May 16, 1888, vol. v. Original.)

8. *Revolving drum,* constructed by Professors E. L. Nichols and W. S. Franklin for studying the direction of the electric current. It was driven during the investigations at the rate of 400 revolutions per second. (*American Journal of Science,* vol. 37, p. 103, February 1889. Original.)

9. *Ryan electrometer.* The original instrument with which Professors Merritt and Ryan conducted their experiments upon transformers in 1889. (*Transactions* American Institute of Electrical Engineers, vol. v., p. 6, 1889.)

10. *Spiral coil voltameter.* A much used copy of the original instrument designed and constructed by Professor H. J. Ryan, 1889. (Described at American Institute of Electrical Engineers, May 22, 1889, vol. vi.)

11. *Horizontal-slit photometer.* Designed by Professor E. L. Nichols and constructed by F. C. Fowler, 1890. This instrument was intended for the study of the spectrum of artificial light directly upon the photometer bar, and has been much used in such work. (American Institute of Electrical Engineers, May 21, 1890. Original.)

12. *Discharger* used by Messrs. Archbold and Teeple in the study of the *ball and point effect*—a peculiar form of alternating arc discharge. (See *American Journal of Science,* vol. xli., 1891. Original.)

13. *Alternate current potentiometer.* Designed and constructed by Professor G. S. Moler in 1891. It takes the place of an alternate circuit voltmeter, and gives results accurate to within 0.1 per cent. (American Institute of Electrical Engineers, May 21, 1891. Copy of the original.)

14. *Curve tracing voltmeter.* Designed by Professor G. S. Moler and constructed by F. C. Fowler (1892). This instrument, which was used to record the rapid fluctuations of current and potential met with in dynamo practice, etc., was described at the American Institute of Electrical Engineers, June 6, 1892. It has been superseded by the galvanometer of Hotchkiss and Mills, No. 22 of this collection. (Original.)

15. *Experimental transformer,* designed by Professors Bedell and Crehore (1891) for special investigations of the transformer, with particular reference to effects produced by an alternation of the reluctance of the magnetic circuit. This transformer was used in the experiments of Professor Bedell on the experimental determination of transformer diagrams. ("Proceedings of the International Electrical Congress, Chicago, 1893." Original.)

16. *Automatic printing speed counter for dynamo shafting.* Designed and constructed by Professor G. S. Moler (1893). The apparatus exhibited, which is the original model, has been in continuous service since 1893. (American Institute of Electrical Engineers, May 1, 1893.)

17. *Apparatus for studying the heating of armatures.* Designed and constructed by Messrs. A. H. and C. E. Timmerman (1893). For the investigations performed by means of this apparatus, see *Transactions* American Institute of Electrical Engineers, vol. x.

18. *Alternating current dynamo,* constructed in the shops of Cornell University by Messrs. Smith and Hall. (Original.)

19. *Water jet instantaneous contact maker.* Designed by Professors Bedell and Ryan, and constructed by F. C. Fowler (1893). This instrument is used in the current measurements with the polyphase current method devised by Professor H. J. Ryan. (*Electrical World,* June 24, 1893.)

20. *Two-phase rectifying commutator,* used by Messrs. Barnes and Stillwell, under the direction of Professor H. J. Ryan, to determine the utility of inductance for constant current regulation from open coil or other forms of polyphase generators.

21. *Sample of sheet iron* laminated, as cleared by etching process, applied by Professor H. J. Ryan, for the productions of laminated portions of experimental alternate current machinery, avoiding the use of dies too expensive for experimental purposes.

22. *Hotchkiss and Mills galvanometer,* in which the flexible connections are made of silver foil, designed by Professor H. J. Ryan and constructed in the workshops of Cornell university by Messrs. Tobey and Walbridge. (1894.)

23. The original Westinghouse *tow-light transformer and switchboard,* used by Professors Merritt and Ryan while making their transformer experiments in 1889. (*Transactions* American Institute of Electrical Engineers, vol. v., p. 6, 1889.)

24. *Special form of mechanical contact* maker for obtaining alternate current curves. Used by Professor H. J. Ryan when determining the behavior of a 17,500 watt transformer in 1892. (*Electrical Engineer,* New York, September 28, 1892.)

25. *Photographs* of a 30,000 volt, to kilowatt transformer, stepping up from 100 volts at 50 periods per second. Designed and constructed in the workshops of Cornell University by H. B. Plumb, 1895. (Described in the *Sibley Journal of Engineering,* June, 1895.)

The W. J. Hammer collection of incandescent lamps represents to a very considerable degree "the history of an art." It starts with original models exemplifying the early laboratory work of such men as Chaugy, Lodyguine, Edison, Sawyer and Man, Swan, Lane-Fox, Maxim, Weston and others. In many cases these inventors and experimenters are represented by numerous forms of lamps, showing in a most interesting way the development in the art as their knowledge and experience increased. To these must be added the following individuals and concerns who are among the many represented in this wonderfully interesting collection, and who by their work have contributed to the development and practical application of the incandescent electric lamp: Müller, Diehl, Siemens & Halske, Siemens Bros., Rogers, Gatehouse, Crookes, Boehm, British Electric, Duplex, Bernstein, Pray, Van Choate, Thompson; Thomson-Houston, Schaefer, Opperman, Vitrite-Luminoid, Novak, Woodhouse & Rawson, Excelsior, Baetz, Greiner, Reinman, Richter, Green, Latimer, de Khobintsky, Goebel, Packard Stanley, White, Westinghouse, Hammer, Jenny "S. A. C.," Perkins, Cruto, Shultzberger, Sunbeam, Fitzgerald, Franklin, Moses, Kurtzgen, Alcester, Alexander, Gerard, "A. B. C.," Sun, Seel, Remington, Heisler-Bernstein, Victoria, Mather, Swan-United, Edison-Swan and Edison-Swan. This remarkable collection has been gathered from many quarters of the globe, America, England, France, Germany, Austria, Italy, Holland, Switzerland and other countries contributing. Mr. Hammer started the nucleus of it at Mr. Edison's laboratory in Menlo Park, where he was an assistant in the early days of Edison's work upon the incandescent lamp. Having charge of and assisting in many of the original experiments, tests, records, etc., he made a practice of col-

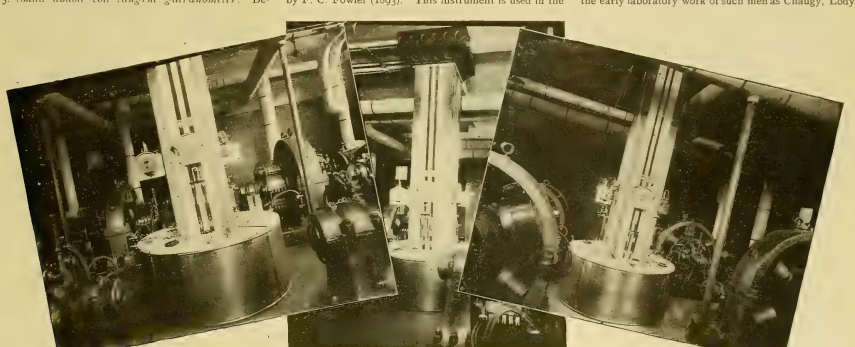


FIG. 3. ELECTRICAL AND MECHANICAL EQUIPMENT OF THE MILWAUKEE CITY HALL.—VIEWS OF ENGINE-DYNAMOS AND SWITCHBOARD.

study of transformers and other alternating current investigations where the instantaneous values of the varying currents and electromotive forces are to be determined. (American Institute of Electrical Engineers, October 18, 1893. Original.)

20. *Wooden drum* with coils of wire, used in the experiments of Professors Nichols and Franklin upon the *condition of the ether surrounding moving bodies.* The drum was constructed with a galvanometer capable of indicating a current of $6\times10^{-10}$ amperes. It was driven at 3,600 revolutions and suddenly stopped. Such was the delicacy of the apparatus that the absence of effect upon the galvanometer served to show that less than one hundred thousand million millionth of the rotating coil depended upon the rotation of the ether produced by its rotation. (*Physical Review,* vol. 3, p. 426, 1894.)

21. *Phase indicator* for alternate current motors, etc. Designed and constructed by Professors Moler and Bedell for determining the changes in the armature lag of alternate synchronous motors under varying conditions. (Described before the American Institute of Electrical Engineers, May, 1894). This instrument was employed in the experiments upon the synchronous motor described by Professors Bedell and Ryan. (See *Journal of the Franklin Institute,* March, 1895. Original.)

22. *Hotchkiss and Millis galvanometer* for the photographic recording of alternating and oscillatory currents.

23. *Set of negatives* obtained with the Hotchkiss and Millis galvanometer.

24. *Laboratory transformers,* designed and constructed by Messrs. J. J. Swann and H. E. Mole (1896). This transformer is one of a number constructed in the laboratory with particular reference to students' use. (Original.)

25. *Apparatus for the measurement of telephonic or minute alternating currents.* This exhibit is the original dynamometer used in making telephonic cur-

lecting with Mr. Edison's permission certain lamps showing important steps in the work, believing they would some day be of great interest and value. Subsequently Mr. Edison gave him nearly all the lamps he had, which now form an excellent record of his work. To these Mr. Hammer has added from time to time during the last 17 years. As five years of this period were spent in Europe, he secured many valuable examples of the early lamps of the foreign investigators. Mr. Hammer also exhibits the only collection in existence of the

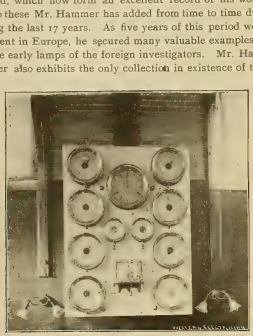


FIG. 4. ELECTRICAL AND MECHANICAL EQUIPMENT OF THE MILWAUKEE CITY HALL.—GAUGE-BOARD.

early substances Edison tried in his endeavors to secure a practical filament for the incandescent lamp.

A striking figure in the intellectual development of New York throughout the last half of the century has been Dr. R. Ogden Doremus, of the College of the City of New York, Bellevue Hospital and other prominent institutions. He has always taken an active part in the advance of electricity as a section of the domain of physics and chemistry, and is manifesting a deep interest in the present exposition. In spite of pressing duties, he has, with the aid of his son, Prof. C. A. Doremus, gathered some of his more interesting apparatus, and is contributing a display which, after all, is but the merest fragment of what might be shown and which is exclusive of the working apparatus to be placed in the "Practical Laboratory." It includes, for example, Henry's experimental induction coil; the famous "tithomometer" devised by Prof. J. W. Draper in 1842; a "titionitype" or copper electrotype of a daguerreotype, and a daguerreotype taken by the doctor in 1844; electrolytic marsh apparatus made by Dr. Doremus in 1860; a battery of which the carbons were obtained from iron gas retorts in 1854, each weighing 90 pounds. There will also be two large prisms, nine-inch aperture, for projection of the spectra of metals, each holding 10 pounds of bisulphide of carbon. These rare scientific curios will be supplemented by one of the cells of the historical old 500 cell battery used at the College of the City of New York; apparatus for fusing metals, apparatus for combustion of explosives in vacuo, and other rare, odd and beautiful things

The amount of interest is remarkable that is being manifested in the proposition to enable visitors to listen to the roar of Niagara. The telephone company is making plans so that several people can hear it distinctly at any hour and all at once. It is not necessary in making connection at the falls to go behind the sheet of water in order to get the full effect of sound, but by placing the transmitter near the Horseshoe, on the Canadian shore, all the tone and quality will, it is said, be clearly obtained. Receivers, to the number or 30 or 40, will be grouped around the little model of the Niagara power plant on the special central platform in the main hall, so that people will see Niagara run and hear it at the same time; the model itself being also driven by current from the falls. It is said that the "note" of Niagara is four octaves lower than the keyboard of the ordinary piano. Eugene Thayer, the celebrated organist, says it is not a "roar" at all, but a "perfectly constructed musical tone, clear, definite and unapproachable in its majestic perfection; a complete series of tones, all uniting in one grand and noble unison as in the organ." F. A. Pickernel, the electrical engineer of the American Telephone & Telegraph company, is in charge of the arrangements for this unique entertainment, which will be open to all visitors to the exposition.

One of the most picturesque features of New York harbor at night is the line of electrically lighted buoys that marks the passage through Gedney's channel at Sandy Hook. This is a unique installation, the current being supplied to the buoys from the shore through long runs of submarine cable, as will be remembered by the readers of the detailed account in the WESTERN ELECTRICIAN of May 28, 1892. These buoys are huge spars of wood 60 feet long, floating at a slight incline from the vertical, the lamp being carried like the head of a walking-stick, and the submerged end being anchored by an iron mushroom weight. The United States Lighthouse Board has kindly placed two of these buoys, ready for lighting, one direct current and one alternating, at the disposition of the exposition management. They will be shown in a length of 12 feet, upright, and the Bishop Gutta Percha company has been good enough to offer runs of cable to carry current to them of the same type as that actually supplied for the real work. These buoys will be placed near the entrance to the exposition, with charts and pictures, and the visitor will thus be able to understand how the thing works.

To ship the exhibit of the United States Patent Office of 360 models of electrical inventions for the exposition required 38 cases. They weigh over two tons. W. A. Mograth of the Patent Office has been specially detailed by the Hon. A. T. Fisher, acting patent commissioner, to take charge of the exhibit.

## Arrangements for the Convention Special.

As announced in the last number of this journal, the Lake Shore company has completed arrangements for a

FIG. 5. ELECTRICAL AND MECHANICAL EQUIPMENT OF THE MILWAUKEE CITY HALL.—CORRIDOR SHOWING FIXTURES, WIRING CONDUIT AND CUT-OUT CABINET.

special train from Chicago to New York for the delegates to the National Electric Light association convention. Persons desiring to take advantage of the special rate and the advantages offered by this arrangement should file their applications for accommodations at once. Of course it is understood that those applying first will be given the preference in the selection of berths. Mr. Wilbur of the Lake Shore company announced last week that all applications should be made by Friday night, May 1st. The following notice has been sent out from transportation headquarters by C. O. Baker, Jr.:

The various passenger associations have granted the rate of a fare and a third on the certificate plan to delegates attending the convention of the National Electric Light association, to be held in New York, May 5th, 6th and 7th. It is positively necessary that delegates when purchasing tickets should state to the agent that they are delegates to the convention of the National Electric Light association and should obtain from him a certificate that they have paid full fare, which certificate, when properly signed in New York, will entitle them to return passage at one-third the regular fare. It is absolutely necessary that this certificate be obtained when tickets are purchased; otherwise it will be impossible to take advantage of the reduced rate returning. These certificates are good going three days prior to the opening of the convention and are good to return only three days after the adjournment. The electrical special will leave Chicago Saturday, May 2d, at 5 P. M., via Lake Shore and Michigan Southern road, arriving in New York at 6 P. M., Sunday, May 3d. Accommodations on this train may be secured by addressing either W. A. Kreidler, 510 Marquette building, or C. K. Wilbur, western passenger agent L. S. & M. S. R. R., Chicago, Ill.

The city council of Schoolcraft, Mich., has granted Rheubottom & Bond of Union City, Mich., a 15-year franchise for an electric lighting plant, to be completed within six months.

## Diffusion of Röntgen Rays.

By Elihu Thomson.

I sent you some time ago a short article on the diffusion of Röntgen rays, and at the time I was not aware that any work of a similar nature had been done, though it is true that certain suggestions had been made as to the turbidity of media by, I think, Lenard and Professor Röntgen.

I find that Dr. M. I. Pupin has, in *Science* of the issue of April 10th, given an account of his investigations on the diffusion of Röntgen rays, which accords with my results in most important particulars. I was not aware that he had done the experimental work which is described in the article and am now pleased to note that he has gone into the subject very carefully and very thoroughly; in fact, more thoroughly than my time permitted my doing.

These observations on the diffusion of Röntgen rays show that sharp, clear-cut shadows of bones, or objects, imbedded in a considerable depth of flesh, can not be expected where the rays have to traverse a considerable depth of flesh after passing the embedded bone or object, and that blurring or diffusion which wipes out the image may be so great as to make it very indistinct if large masses of semi-transparent material are between the plate or screen and the object the image of which is to be depicted. It is easy, also, for the experimenter to be misled into thinking that the diffused rays back of the bone or object really have come through that object, when in reality the presence of the Röntgen rays back of the solid object which casts a dense shadow is due to nothing more than diffusion.

I regret to hear that Dr. Pupin's valuable work in this direction has been interrupted by a serious illness.

## Governor Morton Will Open the Exposition.

[Special correspondence WESTERN ELECTRICIAN.]

New York, April 25.—At three o'clock this afternoon Governor Morton officially accepted the invitation of the management of the Electrical Exposition company to formally open the great exhibition at the New York Industrial Building on May 4th. This acceptance by the governor completes the arrangements for the exercises in connection with the opening of the great show.

W. F. O.

## American Institute of Electrical Engineers.

At the 105th meeting of the Institute, held at 12 West Thirty-first street, New York city, April 22d, about 200 members and guests were present. A paper was read by D. McFarlan Moore of Newark, N. J., on "Recent Developments in Vacuum Tube Lighting." It was accompanied by numerous experiments and the hall was

FIG. 6. ELECTRICAL AND MECHANICAL EQUIPMENT OF THE MILWAUKEE CITY HALL.—INTERIOR COURT SHOWING INCANDESCENT LIGHT FIXTURES.

lighted with Mr Moore's tubes, which were suspended horizontally from the gallery in a double row. Owing to the lateness of the hour of adjournment there was no discussion

At the meeting of the council in the afternoon the following named associate members were elected: Bert L. Baldwin, Cincinnati, O.; Chas. M. Clark, New York, N. Y.; William J. Clark, New York, N. Y.; Henry

George Field, Detroit, Mich.; Curtis B. Flory, South Bethlehem, Pa.; Chris. M. Goddard, Boston, Mass.; Wm. Steell Jackson, South Bethlehem, Pa.; C. W. G. Little, London, Eng.; Chas. P. McCluer, Richmond, Va.; Buckner Speed, Louisville, Ky.; Robert M. Thomas, New York, N. Y.; Alfred A. Thresher, Dayton, O.

The following named associate members were transferred to full membership: W. S. Andrews, Schenectady, N. Y.; Henry G. Stott, Buffalo, N. Y.; Henry S. Carhart, Ann Arbor, Mich.; Russell B. Harrison, Terre Haute, Ind.

It was decided to accept the invitation of the National Electrical Exposition company and hold the annual general meeting in the exposition building, beginning on May 19th.

## How to Write Business Paper Advertisements.

BY N. C. FOWLER, JR.

Advertising pays. Some advertising pays better than some other advertising.

The good of an advertisement is in how it looks, and in what it says. Don't make your firm name too prominent. Advertise what you have for sale. If you're for sale, advertise yourself. If you have something to sell, advertise that something. Have your name in type large enough for folks to see it, but not so large they can't see anything else. Don't put your name at top and bottom of the advertisement. Once is enough.

If you can, advertise specifically, not generally. An advertisement shouldn't be like a business card. It should say something in particular. Conventional advertisement writing pays. Progressive advertisement writing pays better.

The advertising pages of a trade paper are departments of information. They rise above mere advertising space. The trade paper advertisement is as much in the interest of the reader as for the advertiser.

Write your advertisements as you would a letter of solicitation, with more display to it, and with more brevity, your strong points being brought out in large type. Don't ask people to send for orders. That's unnecessary. That's understood. Tell people what you have. Use argument. If your goods and your argument are not strong, then your advertisement isn't any good. In the quality of your goods, and in your ability to write about them, is the selling strength of your advertising.

Plate No. 1 presents the conventional form of advertisement writing, with the firm name inserted twice, and in more prominent type than that used for the articles for sale. Plate No. 2 presents the same advertisement as illustrative of the simple and effective modern style The typographical display of the second example gives

Plate No. 1 Plate No. 2.

HOW TO WRITE BUSINESS PAPER ADVERTISEMENTS.

the advertisement increased value, for in display, almost as much as in words, is effectiveness.

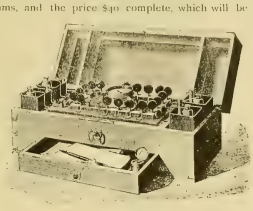
In sending advertising copy to a trade paper, always specify the words, or lines, you desire to have prominent. A good way is to underline the words or paragraphs, the very unimportant words not to be underlined, and one, two and three or four underlines to represent, respectively, the degrees of type sizes. The meaning of this underlining will be understood by all compositors. Whenever it is necessary to bring out one word, or line, in unusually large type, it is well to specify it with a note to that effect.

Plate No. 2 is so arranged that the two strong words stand in bold relief, and will be seen by even the casual reader. It is always advisable to bring out some word, or illustration, as a sort of eye-arrester, in order that the skimming-over reader will absorb it if he gives only a glance at the advertising pages.

An advertisement must contain argument, and be of a typographical or illustrative character that will focus attention.

## Desrulles' Bridge.

A simple form of Wheatstone bridge of French origin, which commended itself at once to a practical inspector, is shown in the accompanying illustration. The box is furnished with a handle for transportation and the outfit contained comprises eight dry battery cells, a galvanometer and a bridge. There is also a drawer which may be utilized to carry either cord or writing materials the former if used by a practical hustler, the latter if by a theoretical electrician. The capacity of the set is 10 megohms, and the price $40 complete, which will be an



DESRULLES' BRIDGE

other feature of interest to those having occasion to use instruments of this class.

## Telephones and Telegraphs at the Republican National Convention.

George F. Durant, the Bell telephone manager in St. Louis, has a new scheme to facilitate business in the coming Republican national convention. The proposition has not yet gone before the sub-committee having charge of the convention arrangements, but it is said to be practically assured that it will be adopted. The plan is to connect the various state delegations with the speaker's desk by telephone, so that the chairman may know the name of every man who is recognized and thus be able to announce his name to the convention. The telephone scheme, it is claimed, will do away with the annoyance and loss of time that has so long been a source of worry to the managers of national conventions. The details of the plans proposed do not differ from the system of interior telephony in vogue in the large hotels. There will be a central office back of the speaker's stand, and from there an operator will connect the various delegations with the chairman or with each other, as the case may be.

The other arrangements for giving the news to the outside world by telegraph will be the finest and most complete ever attempted at a national convention. In order to be able to handle the great press of business the Western Union company is stringing six new copper wires from St. Louis to Chicago, and four from St. Louis to New York. This will give St. Louis the best telegraphic connection with the outside world it has ever had. About 50 loops will be run into the convention hall. The Postal company is also making preparations for the occasion. Three new copper wires are being strung between St. Louis and Chicago, and two more to New York city direct.

## BOOK TABLE.

WESTINGHOUSE ELECTRIC STREET CAR EQUIPMENTS. By Frederick L. Hutchinson and Leo A. Phillips, associate members of the American Institute of Electrical Engineers. East Pittsburg, Pa.: 1896. Price, $1

This book is written for street car men on lines using the Westinghouse system. It contains a complete description of the various street car motors, controllers and other car equipment apparatus manufactured by the Westinghouse Electric & Manufacturing company, with full directions for proper inspection and repair, including rewinding and connecting armatures, together with complete information regarding the operation of the various devices and explicit instructions for locating and remedying any electrical trouble that may be encountered. The authors have endeavored to put all directions, diagrams and illustrations into such form as to be readily understood by any ordinary man without previous electrical training, and have aimed to give practical rather than theoretical information. The book is bound in flexible leather, for the pocket.

Sealed proposals are invited until May 7th for furnishing the Treasury Department at Washington with electrical supplies, including batteries, call-buttons, bells, cuts, plugs, shades, rubber tape, wire, zincs, etc. Bidders can obtain specifications and additional information by addressing Logan Carlisle, chief clerk and superintendent, Treasury, Washington, D. C. Proposals are also being invited until May 7th for furnishing the government printing office with electric supplies during the fiscal year ending June 30, 1897. Intending bidders can obtain additional information upon application to T. E. Benedict, public printer, Washington, D. C.

## Mineral Production for 1895.

Advance sheets of the elaborate compilation of statistics of the mineral and metal production of the United States made annually for the "Mineral Industry," issued as a supplement to the *Engineering and Mining Journal*, shows a decided increase in values, the totals being 1894, $544,170,058; 1895, $628,881,505. Richard P. Rothwell, who compiles the statistics, makes this comment:

The year 1895 was, as most of our readers are well aware, one of general depression, of decreased production and demand. In most of the leading articles of mineral production 1895 showed a notable revival, and while we cannot claim to have reached the full measure of prosperity which we hoped for, the record for the past year is still a very encouraging one. In some cases the production for the year was the largest ever yet attained, and in others such gains were made as to show the possibilities of the future.

Generally it may be said that in the precious metals gold showed a large increase and silver a smaller decrease than had been expected. In the useful metals and minerals coal showed an enormous increase, amounting to 17 per cent., and the materials of construction also gained largely in amount. Our production has been developed on a few new lines, while showing no very important changes in direction during the year.

The figures given show that the United States last year took the first rank as a producer, not only of the precious metals, but also of the most important of the useful metals, iron and copper, while in coal it is still second only to Great Britain, with the certainty that in a few years it will take the first place. That this degree of development has been reached in a comparatively short period makes it all the more extraordinary, even when we consider the wonderful resources of the country.

In that portion of the summary treating specifically of copper—the metallic barometer of electrical development—these figures are given:

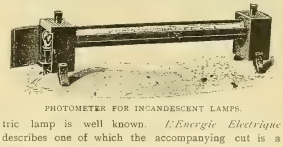
The production of this metal in 1895 amounted to 175,294 metric tons (386,453,830 pounds). Thus the output, which showed an actual increase in quantity even during the years of depression, again displayed a steady growth, and the increased demand at one time during the year forced prices up to the highest level known for several years. While this gain was not fully maintained there was still a substantial improvement in the average price for the year. Nearly all the leading mines maintained their output, and many of the smaller ones increased it considerably. There was a decrease of about 12 per cent. in the exports of copper for the year, so that the increase in price was largely due to the heavy domestic demand.

The production by states was as follows:

| States. | Pounds. |
|---|---|
| Arizona | 48,399,403 |
| Michigan | 129,740,765 |
| Montana | 194,768,925 |
| Colorado | 6,125,000 |
| Utah | 2,664,757 |
| Eastern and Southern | 3,255,000 |
| All others | 1,500,000 |
| Total production | 386,453,850 |

## Photometer for Incandescent Lamps.

The difficulty of getting proper apparatus for establishing a photometric measurement of an elec-



PHOTOMETER FOR INCANDESCENT LAMPS.

tric lamp is well known. *L'Energie Electrique* describes one of which the accompanying cut is a representation, and indorses it as capable, for all practical purposes, of measuring the light of any lamp between five and 32 candles.

The photometer is one meter in length, and can be used in an ordinary lighted room. A standard candle is enclosed at one extremity, and the lamp to be compared in the other, as shown. The scale on the front of the instrument gives a direct reading of the proportionate illumination. As this can be read easily, the measuring of many lamps is but the work of a few minutes.

## Prof. Thomson Lectures on X-rays.

Before the Electric Potential club of Boston, on "ladies' night," April 22d, Prof. Elihu Thomson gave a very enjoyable lecture on the Röntgen X-rays, illustrating his address by interesting experiments, including the making of a sciagraphic negative before the audience. Prof. Thomson gave the ladies and gentlemen present a clear account of Prof. Röntgen's discovery and summarized the subsequent investigations. The practical utility of the discovery, he said, was constantly increasing in value Before the lecture there was a dinner and reception

Western Electrician.
EVERY SATURDAY.

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**Trade Supplied by Western News Co.**

**COPYRIGHT.**—Not only the title but the *entire contents* of each number of the WESTERN ELECTRICIAN are copyrighted. This paper is entered at the Chicago postoffice as mail matter of the second class.

**SUBSCRIPTION,** in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

**ADVERTISING.** THE WESTERN ELECTRICIAN — **the only general electrical paper published in the West**—thoroughly covers a territory *entirely its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

## HIGH WATER MARK
## CIRCULATION, 16,630.

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THE publication offices of the WESTERN ELECTRICIAN have been removed to much more commodious quarters. Our new address is Suite 510 Marquette building, Dearborn and Adams streets, Chicago.

The telephone number remains unchanged—Main 1746.

ONE of the latest properties attributed to Röntgen rays, according to announcements in the daily newspapers, is the power of destroying the "gems" of infectious diseases. This disclosure is said to be the "result of Professor Pratt's scientific investigation."

TOO MUCH value cannot be attached to the importance of providing current technical literature for men engaged in engineering and similar pursuits. This fact is evidently appreciated by the Western Society of Engineers, judging from the announcement of the secretary that the organization has on file in its reading rooms in Chicago over 150 periodicals regularly received. This is certainly a very valuable feature and speaks well for the management.

EVERY DAY seems to bring some new evidence of the advancement of the trolley, and many of these testimonials come from unexpected quarters. One of the most striking illustrations is presented in the recent announcement of the Chicago Veterinary College, which, in explanation of a marked decrease in its graduating class, announced that the general introduction of the trolley had so lessened the demand for horses that the field for veterinarians was radically contracting. This year class had only two-thirds as many members as that of last year. The faculty of the college made no effort to hide the fact that the trolley was seriously affecting the business of veterinary surgeons.

CENTRAL station men who do not attend the meetings of the National Electric Light association sometimes advance the excuse that their business will not permit of their absence even for a week; they must be constantly on hand to direct it. This does not speak well for their management. Any well organized and properly conducted business does not require the presence of any particular man at all times. When it becomes necessary to have a certain officer or employe constantly on hand to keep the wheels of the machine in operation, it is time to institute an investigation and order a change in the policy and methods of the management. It is well for every manager of a business enterprise to be acquainted with the details of operation and to watch the conduct of the business carefully; but when the absence of any man from his post results in disorder or inconvenience it may be taken for granted that there is something radically wrong with the system of management.

THERE is no man in the entire electrical fraternity more generally admired and esteemed than Elihu Thomson, and there is no one more considerate or more willing to acknowledge the value of others' work than he. Recently in his experiments with Röntgen rays he found that he had given out some erroneous impressions, and as soon as his attention was directed to the matter he hastened to make correction and call attention to the work of other experimenters, Professor Stine and Messrs. Scribner and McBerty, who, more fortunate than he, had avoided the error into which he had fallen. Another instance in which his sturdy manhood is displayed is presented in the contribution in this issue in which he calls attention to the fact that certain results noted by him in a recent article in the WESTERN ELECTRICIAN were previously reported by Dr. Papin in another publication. The latter's contribution did not come under Professor Thomson's eye until after the publication of his article, and now Professor Thomson magnanimously states that Dr. Papin's experiments were conducted "very carefully and very thoroughly—in fact, more thoroughly than my time permitted my doing." This is certainly a very graceful compliment. We commend Professor Thomson's conduct to the attention of other experimenters, less distinguished than he, who would do well to follow his example.

AS USUAL the first special convention number of the WESTERN ELECTRICIAN, the issue that will be distributed at the meeting of the National Electric Light association next week, will be devoted largely to the convention and the exposition. It will be an unusually attractive number and will contain among its special features contributions from the leading men in every branch of electrical work. In this it will exemplify the happy combination of theory and practice that is found in all successful electrical enterprises. It will contain the latest information about the convention and the exposition, what will be done at the former and shown at the latter, thus providing delegates and visitors all the necessary information concerning the great gathering at the metropolis. Not the least attractive feature will be the illustrations. They have been prepared with great care and at considerable expense, and are in keeping with the reputation of this journal, and this of itself is sufficient guarantee of their excellence. The second convention number, which will be issued the following week, will contain the report of the proceedings, descriptions of the exhibits, a list of delegates in attendance and the usual amount of interesting notes and comments incident to the meeting. These special numbers will be the most complete as well as the most interesting publications dealing with this important gathering.

IN its organization and management the American Institute of Electrical Engineers is a remarkable body. Theoretically the Institute is governed upon the popular plan of majority rule, with proper consideration for the views of the minority, and the will of the members as expressed by ballot is supposed to be supreme; but in reality the government devolves upon the council, and the gentlemen who have dominated this governing board have so arranged matters that it has been found well-nigh impossible to displace them or curtail their powers. It is therefore an example of rule by minority without the slightest consideration for the wishes of the majority. For instance, before the annual election of officers each year the members have an opportunity of signifying their choice for candidates for the offices to be filled, and the gentlemen securing the highest number of votes for any position naturally expect to see their names placed upon the regular ticket, but very often this does not happen. The council takes upon itself the responsibility of selecting a ticket from the names of those voted for, whether or not the candidates of its choice are desired by the majority of members as shown by the preliminary ballot. The plan of making nominations now followed is a farce and might well be dispensed with. There is warrant in the constitution, it is true, for the present method of procedure, and it is likewise true that there are many other silly things done under sanction of that document.

THE annual report of the General Electric company is much like the statements of former years in that it throws no light upon those features of the company's business in which the greatest interest is manifested. The management does not take the public into its confidence, and so far as the report is concerned the stockholders are treated with scant consideration. It would seem that a more specific statement of the relations between the General Electric company and the Westinghouse interests might have been advantageous. Those who are familiar with the system of bookkeeping employed by the General Electric company may possibly derive some satisfaction from the report, but to the general public the financial condition of the concern, so far as the statement presented in this document, is not disclosed. That portion of the report which deals with the manufacturing department is interesting from the fact that it shows that material progress is constantly being made in all lines of electrical development. The successful establishment of several important power transmission enterprises, the introduction in Chicago of electricity in the operation of the elevated railways, and the result of the B. & O. experiment with 90-ton electric locomotives, as well as marked advancement in other lines, prove conclusively that there are still excellent fields to be cultivated and new applications to be developed. Some interesting figures are given which convey an idea of the magnitude of the business of this company. The list of securities held by the company also forms an interesting and instructive feature of the document.

IN a letter recently received from the general manager of a large central station furnishing light and power in Michigan, the writer commends the position taken by the WESTERN ELECTRICIAN upon the subject of municipal control of electric lighting plants and adds the following suggestions:

The National Electric Light association should give the municipal lighting matter more attention. It would interest managers of existing plants much more than half the papers and discussions which usually occupy the meetings. There should be appointed a good, strong committee for the purpose of obtaining information concerning cost of operating municipal plants, and if it can be shown, after going over the whole list of existing municipal plants, that they are saving money for all of the taxpayers, then private companies should quit "hollering" and let them do the business.

The association has devoted considerable attention to this subject, and we agree with our correspondent that it should continue its investigation, as the matter is of vital importance to every member of the organization. Central station managers who are familiar with the subject, and know exactly how much it costs to produce current, invite this investigation, as they realize how absurd are the claims of such men as "Professor" Barrett and Mayor Pingree. There is no doubt that misrepresentations are made by city officials to influence taxpayers, and that accounts are kept with the view of hiding the true state of affairs, rather than disclosing the exact cost of service. This conclusion is justified by the experience of those who have endeavored to get an insight into the condition of the Chicago electrical department and by the attitude of John P. Barrett before the Cape May convention. The interests of the association and the central station managers throughout the country can best be served by creating a popular demand for a correct and detailed statement of the actual expenditures of every municipal electric plant in the country. What is wanted is an explicit statement of facts. This it seems cannot be gotten from the city officials. Their statements cannot be relied upon. It remains, then, for the central station managers to procure this information. The National Electric Light association should lend its influence to the movement.

## "Electrical" Fires.

By C. C. Haskins.

There is in the average human being a large element of imitation, and one is sometimes reminded of a flock of sheep by the readiness with which the rabble follows a leader. If the leader of the flock considers it the proper thing to jump over some diminutive object—a stone or a stick—every last ram, wether and nannie will bound over that spot, simply because the bell-wether did, regardless of consequences.

It is much the same with those who permit themselves to be educated by patent medicine advertisements. Printers' ink will make an impression if properly applied, and the crowds that flock to the doors of the bargain stores before opening time on Monday morning testify at once to the gullibility and the "follow-the-leader" characteristic of ordinary mankind.

Mingled with these elements of the ordinary people there are others which heighten the general coloring and are rarely found in other animal species, the most marked of which is a craving for something sensational, something abnormal, that calls for a sudden throwing up of the hands in token of holy horror—a murder, a suicide, a bank robbery, an outrage or calamity of almost any description, providing its magnitude is sufficiently ponderous.

The aim of certain daily newspapers seems to be to feed this morbid craving, and straining a point is often indulged in to accomplish the end sought in a manner both wonderful and amusing. When this desire on the part of a half-baked "scientific" reporter bubbles over while handling electrical questions, those who have made a life-long study of electrical laws are much in the condition of awe and admiration of Goldsmith's rustics:

And still they gazed, and still the wonder grew,
That one small head could carry all he knew.

Two recent cases of incipient conflagrations, quickly disposed of by the Chicago fire department, were reported by some erudite newspaper scientist as being caused by electric light wires. One of the buildings has not now, and never did have, an electric light wire in or on the premises. The only electric current used is that furnished by a couple of batteries for ringing bells and for lighting the gas chandeliers. On another occasion, on the fourth floor of a business place in the heart of the city, a storage and lumber room was burned through a spark from an adjoining chimney, as it afterward appeared. There were in the place a couple of cells of a disused and abandoned battery, with no wires attached, and the learned newspaper pundit pronounced it a veritable electric fire. There was no electric wire, no current, no complete battery in the room, but that was of no consequence when a sensational craving could be so much better gratified.

Not so very long since a fire was charged to the deadly current from a motor, which investigation showed was caused by the engineer of the house leaving a candle burning without a holder of any kind, which very naturally burned down, and as it was in easy reach of inflammable material, it played the role of incendiary. Repeated instances might be mentioned where fires have been caused—according to these Solomons of the quill—in buildings where there never was even a battery, and one case was called to mind the other day where an iron stovepipe wire was charged with setting fire to a business house, and the wire was displayed in evidence by an investigator.

There was a time when gas was alone responsible for the "unknown," and the rat which invaded the boudoir and counting-room with a sheet of sandpaper on his nose or under his arm, hunting for matches, had his day as a fire fiend; spontaneous combustion was once popular as an incendiary, but to-day the new-fangled turnspit and illuminator, electricity, can cross a bridge of insulation as wide as the South Branch, on occasion, and can set fire where there is only a wire without current. According to the electrical theories of these savants of the daily papers, we may yet learn that a barrel of insulators is dangerous, and an ohm may be united to a volt somewhere in the bosom of a microfarad, drop accidentally on an ampere and develop an X-ray so powerful as to blow up Lake Michigan! The terrible results they may thus conjure up would be quite in keeping with what they do publish, and they bring to mind the story of Miss Mugg, whose glance fired an English playhouse:

'Twas all accidental they cry
Away with the flimsy humbug!
'Twas fired by a flash from the eye
Of Lady Elizabeth Mugg.

---

The city of Oshkosh, Wis., is taking bids for lighting the city with arc lights

## General Electric Company's Annual Report.

The annual meeting of the General Electric company will be held at Schenectady on Tuesday, May 12th. In his annual report President Coffin calls attention to the fact that the business secured by the company during the year was less than 10 per cent. greater in value than the previous year, although the volume was more than 30 per cent. greater. He says:

As will be seen by the statement of profit and loss, the business of the year just closed, including royalties, amounted to $13,315,667.12; cost of goods sold, plus legal, patent and general expenses and taxes, was $11,759,857.08, leaving a balance of $1,555,810.04, less interest on debentures in excess of interest and dividends received, $16,459.40, sundry losses, $27,178.31 and depreciation on inventories and consignments, $123,204.87, making $166,842.58 and leaving $1,388,967.46. There is charged off, in writing down factory plants, patents, etc., the sum of $511,321.97, leaving net, $877,645.49.

From the first vice-president's report it will be seen that more than 90 per cent. of all the sales for the year were on the basis of cash within 60 days from shipment.

As might have been expected, there is absolutely nothing of value in the reference to the arrangement with the Westinghouse company:

Since the close of the fiscal year a contract has been concluded with the Westinghouse Electric & Manufacturing company, which embodies a recognition of the patents of each company by the other and the right, subject to certain exclusions, to a joint use thereof. An official notification of this contract was given out on March 13th, and since then details necessary to make the arrangement effective have been concluded. It is believed that many advantages will be derived from this contract, especially in eliminating much costly patent litigation, and in the important relations of coöperation in engineering and manufacturing methods.

First Vice-president Griffin's report contains the interesting statement that the company has over 10,000 customers, and during the year received 140,000 separate orders, a daily average of 350. An idea of the business transacted can be gained from the following: "Besides our regular supply business, which comprehends not less than 9,000 separate articles, including renewal and repair parts of machines, we sold nearly 12,000 complete machines, having a total capacity of about 500,000 horse power. These figures include over 8,800 street car motors and over 90,000 horse power of railway generators. We also sold nearly 6,000,000 incandescent lamps, over 27,000 meters and other auxiliary apparatus and supplies in proportion."

Special mention is made of the successful introduction of 90-ton electric locomotives on the B. & O. road, the equipment of the Nantasket branch of the New Haven company's system, the substitution of electric motors for steam locomotives on the Brooklyn Bridge lines, the operation of the Chicago elevated railroads by electric motors, and the experiments with the underground conduit system in New York and Washington. In power transmission the Fresno, Cal., plant is mentioned as the crownings feature of the year's work, and special application in the chemical arts are alluded to as opening an entirely new field.

The work of the engineering department is considered in detail by the third-vice-president, E. W. Rice, Jr. His conclusions, briefly stated, are as follows:

In general, the demand, as indicated by many of the installations mentioned, has been for a largely increased size of electrical unit, whether of generator, motor or transformer. While a few years ago a generator of 200 horse power was considered large, we have built during the past year or had on order February 1st some 30 generators of 1,000 horse power and over.

The advantage to our customers in this change to large units, and particularly to generators coupled directly to the engine shaft, is strikingly illustrated in the case of one of our largest street railway customers which has recently replaced generators of the belted type of 400 kilowatts each, with direct-coupled apparatus of an average of about 1,300 kilowatts each, thereby increasing the capacity of their principal station, without increasing its size, from 7,200 kilowatts to 12,000 kilowatts, or about 66 per cent.

Interest will center in the statement of the second vice-president, J. P. Ord, who reports upon the financial affairs of the company. He says: "It has not been necessary to borrow money, nor has the company's credit been used during the year either by issuing notes, indorsing customers' paper for discount or lending its name in any way to allied companies or others. The average cash balance during the year has been $578,000 and all purchases during the year have been paid for in cash."

Accompanying the report were the "Consolidated Balance Sheet of January 31, 1896," and the "Consolidated Profit and Loss Account of January 31, 1896." Both of these documents are herewith reproduced.

### Consolidated Balance Sheet of January 31, 1896.

**ASSETS.**

| | | | |
|---|---|---|---|
| Patents and Franchises | | | $8,000,000.00 |
| Factory Plants | | | 3,468,002.00 |
| Real Estate (other than factory plants) | | | |
| Edison Bldg., N. Y. City | $412,584.63 | | |
| Less mortgage thereon | 200,000.00 | | |
| | 212,584.63 | | |
| Other Real Estate | 241,000.00 | $453,584.63 | |
| Stocks and Bonds (see Schedule A) | | 5,479,332.23 | |
| Notes and Accounts Receivable | | 6,584,123.30 | 12,517,040.16 |
| Cash | | | 879,685.75 |
| Work in Progress | | 961,386.38 | |
| Inventories. | | | |
| At Factories | 3,418,572.60 | | |
| " Local Offices | 714,540.81 | | |
| Consignments | 86,770.25 | | |
| | | 4,219,883.66 | 5,181,270.04 |
| Profit and Loss | | | 13,917,071.48 |
| | | | $43,963,069.43 |

**LIABILITIES.**

| | | |
|---|---|---|
| Capital Stock | | |
| Common | $30,460,000.00 | |
| Preferred | 4,252,000.00 | $34,712,000.00 |
| 5% Gold Coupon Debentures | | 8,750,000.00 |
| Accrued Interest on Debentures | 72,916.65 | |
| Accounts Payable | 428,152.78 | 501,069.43 |
| | | $43,963,069.43 |

### Consolidated Profit and Loss Account of January 31, 1896.

**EXPENSES.**

| | | |
|---|---|---|
| Cost of Goods Sold | $9,860,216.09 | |
| General, Patent and Legal Expenses and Taxes | 1,899,640.99 | $11,759,857.08 |
| Sundry Losses | 27,178.31 | |
| Depreciation on Inventories | 101,191.43 | |
| Consignments | 22,013.44 | 150,383.18 |
| Interest on Debentures | | 437,500.00 |
| | | 12,347,740.26 |
| **Balance carried down—Profit of the Year** | | 1,388,967.46 |
| | | 13,736,707.72 |
| **Balance January 31, 1895** | | 14,794,716.97 |
| Written off Factory Plants | 322,339.43 | |
| " " Other Real Estate | 29,718.52 | |
| " " Patents and Franchises | 159,264.02 | 511,321.97 |
| | | $15,306,038.94 |

**EARNINGS.**

| | | |
|---|---|---|
| Sales | $12,730,058.[illegible] | |
| Royalties and Sundry Profits | 585,6[illegible].05 | $13,315,667.12 |
| Interest and Dividends received on Securities owned | 320,256.54 | |
| Interest and Discount | 100,784.06 | 421,040.60 |
| | | 13,736,707.72 |
| **Balance brought down** | | 1,388,967.46 |
| **Balance January 31, 1896** | | 13,917,071.48 |
| | | $15,306,038.94 |

## The Bullard Transformer.

There has been during the past two years a noticeable increase in the demand for high-grade, economical transformers. Central station managers throughout the country are realizing that it is the measure of constant loss on open secondaries, or what is usually termed the leakage current, which is constantly passing through a transformer, whether the lights are on or not, that constitutes the actual economy of a converter. Comparatively speaking, there are but few transformers on the market at present that realize the ideal of what a converter should be. But after a long series of experiments, involving great care, technical knowledge and expense, the Bullard transformer, which has just been placed upon the market and is herewith illustrated, is claimed to offer to the central station a higher degree of economy than has yet been considered possible when combined with close regulation.

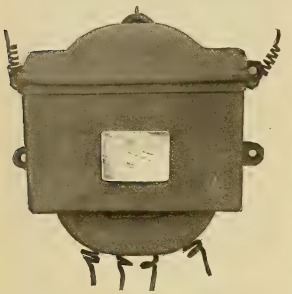


FIG. 1. THE BULLARD TRANSFORMER.

It is pretty generally understood that a high degree of excellence in a converter is only obtainable by the use of the best material, put together without regard to expense. The highest priced technical knowledge has been used in the electrical determinations of the Bullard transformer, and no expense has been spared in the purchase of the softest and most desirable quality of iron that has as yet been used for this purpose. The Bullard Electric company, the manufacturer of the Bullard transformer, has been actuated in its experiments by the belief that many plants in the country desire the most economical converter obtainable, without reference to the slight existing difference in first cost. This company claims that it will to-day demonstrate, by offering the transformer for private test, that a net saving of four or five dollars per year per thousand watt converter can be made by the use of the Bullard converter, even in place of the next highest grade transformer upon the market. This is a sweeping claim, but no transformer on the market to-day is barred from competition.

There were numerous preliminary and exhaustive tests of the Bullard transformer, made by celebrated electricians during the last few months, before it was deemed advisable to solicit orders. The most recent and exhaustive test, made by Prof. H. S. Carhart of the University of Michigan, on a twenty light or thousand watt transformer, is herewith appended:

*Efficiency.*—Full load, 95.18 per cent.; three-fourths load, 95.11 per cent.; one-half load 94.47 per cent.; one-fourth load, 91.66 per cent.

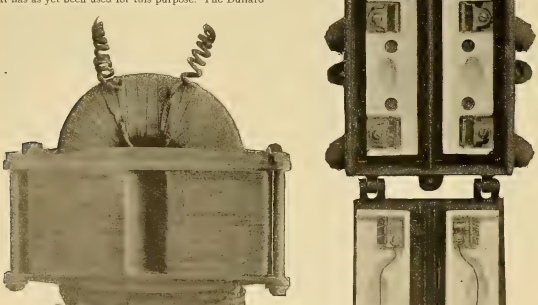
*Regulation.*—Full load, 2.52 per cent.; three-fourths load, two per cent.; one-half load, 1.27 per cent.

The watts loss on open secondaries in this test was 23.6, while the rise in temperature after more than one hour with full load was 21 degrees Fahrenheit.

The Bullard Electric company challenges any manufacturer of transformers to equal this result on a 1,000 watt converter. The larger sizes are, of course, proportionately better.

All of the Bullard transformers are made with greatest care, only mica insulation being employed. Before final taping, all of the coils are thoroughly saturated and boiled in a compound of the highest insulating qualities, and are then baked to a solid mass by being subjected for several days to a very high degree of temperature. The transformers are made either for 2,000 or 1,000 volts primary, as may be desired, and for two reductions on the secondary.

Fig. 1 gives a picture of the transformer in case ready for installation. Two hooks for adjusting to cross-arms are packed with each transformer, so that it may be expeditiously installed on poles. Fig. 2 shows the general arrangement of the coil, ready to be placed in the case. A desirable feature of this transformer is that the coils are not in any way bolted or screwed into the case, the arrangement being such that the bolting down of the cover holds the coil in a firm and rigid position. Fig. 3 represents the general arrangement of the fuse-box, open. The Bullard transformer is made with detached fuse-box, as the old method of having fuse-box attached to the case of the transformer is attended with so many difficulties in replacing fuses that it may be said to be becoming obsolete.

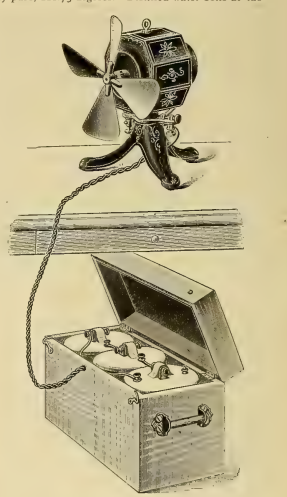


FIGS. 2 AND 3. THE BULLARD TRANSFORMER.

The Bullard Electric company offers an exceptionally liberal guarantee, which suggests the confidence that the manufacturers have in their product. It is prepared to send out attractive descriptive literature, and will be pleased to answer all inquiries and give information to all managers who wish to realize all the economy possible in the maintenance of their plants. Those desiring information should address Warren Carpenter, secretary of the Bullard Electric company, 1563 Monadnock block, Chicago.

## Edison Battery Fan Motor.

Electric fans adapted for operation by primary battery current are a necessity in many situations, if electric fans are to be employed at all. The outfit herewith illustrated is made by the Edison Manufacturing company, 110 East Twenty-third street, New York, and is now ready for the hot weather. It consists of an ironclad motor with a seven-inch fan, battery cords, three Edison-Lalande batteries, with charge to run the motors 75 hours, in an oak box 18¾ by 7 by 9¾ inches. The motor is noiseless, has self-oiling bearings, and is entirely enclosed in an ironclad case, being provided with a glass window at the rear for regulation of brushes. The workmanship is of the very highest grade.



EDISON BATTERY FAN MOTOR.

## The Boiling Point of Water.

The statement that water boils under atmospheric pressure at a temperature of 212 degrees is easy to recollect, but it does not comply with the facts in the case, except under certain conditions. Pure water, that is distilled water, boils at 212 degrees when the pressure of the atmosphere is 14.7 pounds absolute. Pure water is only found when it is the result of distillation. The atmosphere exerts the above mentioned pressure only at sea level and under certain barometric conditions. At all altitudes greater than sea level the boiling point is less. In Chicago it is, for Lake Michigan water, naturally pure, 211.75 degrees. Distilled water boils at the same place at a temperature of more than one degree less. In many parts of Colorado water boils in the open air at a temperature of less than 200 degrees. When water contains impurities, mineral or otherwise, the boiling temperature is raised a number of degrees.

Some recent experiments on this subject, made in Chicago, showed that the boiling temperature of water from Lake Michigan was 211.75 degrees and, also, that in a common tin vessel where there was no obstruction to the circulation or preventive of ebullition, except the cohesion of the water, 71.72 heat units were required to start and keep the water in motion.

A similar experiment on water from Chicago River gave 218.25 degrees as the boiling temperature and 113 heat units required to set it in motion. The latter is a factor not often considered when calculating the transformation of heat energy into power by the use of steam; but that it is an important factor is shown by the figures given above. As water boils away and fresh water is added, that which remains soon becomes saturated with mineral, and in some cases vegetable, matter which raises its boiling point; that is why Chicago river water requires so much higher temperature to bring it to the boiling point—because it is of greater density, owing to the foreign matter held in suspension.

As the water becomes denser, or rather of greater specific gravity, owing to the foreign matter which it contains, the boiling point is raised proportionately. During the experiment with the Chicago river water, where the sample was boiled in a tin pail, the boiling temperature rose gradually, as a portion of the water was evaporated, until the boiling temperature finally reached 300 degrees and the solder on the bottom of the pail melted. Just previous to the melting of the solder

the density of the water had become so great that it was necessary to stir it with a wooden spatula to keep it in motion, as the heat was not sufficient to produce ebullition and circulation.

It would have been interesting if the experiment had been carried out with a closed vessel and steam produced, as then the temperature at which steam, at given pressures, could be made from such water, would have been determined. The result would probably have given sufficient explanation, to some people, for some boiler explosions that have occurred on Chicago River Further research in this direction would certainly give some valuable information for engineers in Chicago. – *Heating and Sanitation.*

## CORRESPONDENCE.

### New York Notes.

NEW YORK, April 25. George W. Gladwin, of the H. W. Johns Manufacturing company, says that reports have been made recently from many places in the West of the operations of a swindler who was passing himself off as a representative of the company, and thus obtaining large sums of money by means of forged checks and otherwise. The pretended salesman in each case carried with him printed checks on the Bunker Hill National Bank of Boston, purporting to be signed by "The Johns Manufacturing company, E. M. Bennett, treasurer." The Bunker Hill Bank has received checks of this kind amounting to $750. Payment of them was refused on the ground that there is no such company as the "Johns Manufacturing company," and no such official of the H. W. Johns Manufacturing company as "E. M. Bennett." The secretary of the latter company is Charles H. Patrick. Mr. Gladwin thinks that all the frauds have been perpetrated by the same person, who is described as an elderly man, with dark eyes, a light mustache, somewhat bald and weighing about 210 pounds. E. A. Mason, general salesman of the company, had a rough experience in Saratoga recently as a consequence of the descriptions of the swindler, which have been widely circulated. Mason started out on a trip Saturday afternoon, arriving in Saratoga that same night. The police of that city received him with open arms, and, scorning all explanations, locked him up as answering perfectly the descriptions given of the swindler, even to his trunk and its brass asbestos sign. Mason spent Sunday in jail, and was only released on Monday after his identity had been established.

The new electric railway line of the Bergen County (N. J.) Traction company will open a section of the county which heretofore has been practically inaccessible. It runs from Pleasant Valley up the face of the Palisades to Palisade avenue, thence north to Main street, Fort Lee, west along the avenue to the borough of Leonia. It then takes a northerly course along Broad avenue to Englewood, thence running westerly toward Hackensack. The road will, besides tending to increase the value of real estate, bring the eastern and western sections of Bergen county in closer communication with each other. The road is a single track affair of standard gauge, and is built on the most modern and improved order of railway construction. The entire plant is one of the best for its size in the state. The plant is entirely duplicated in case of the breaking down of any part of the machinery. In connection with the railway the company has erected a handsome ferry house fitted with the modern improvements.

The "reformers" in the Legislature are active. Senator Wieman has introduced a bill regulating the price of electric lighting in New York city and Brooklyn. It has been long in committee, but was reported favorably to the Senate, with Senators Brown, Malby and Chahoon dissenting. Senator Brown moved to disagree with the report. Senator Malby said that the bill would drive the electric lighting companies in New York and Brooklyn to bankruptcy. Senator Wieman said the bill fixed fair prices and should be advanced. Senator Malby replied that many of the electric lighting companies never paid a cent of dividends and the arbitrary provisions of the bill were ruinous. No evidence was produced before the committee as to the financial standing and profits of the companies affected. He moved that the bill be referred back to the committee. Finally Senator Brown's motion was withdrawn, and the bill went into general orders.

W. F. O.

### Washington, D. C.

WASHINGTON, April 24.—The construction of the Washington, Alexandria & Mount Vernon railroad is almost completed, and it is expected that within a few weeks electric cars will be running from this city to the home of Washington. The road is owned almost entirely by Philadelphia capitalists. The company was originally capitalized at $500,000, but since then it has been authorized by law to increase its stock to $1,000,000. The company has already a completed trackage of 25 miles. The track from this city to Mount Vernon is 17 miles in length, while the double tracks and the line to Arlington and Rosslyn make up the difference. Where there is but a single track there is a turnout every 3,000 feet, so that with the block system and signals the same as are used on the Pennsylvania railroad safety will be insured. The road crosses the Potomac over the tracks of the Pennsylvania railroad on the Long Bridge, and the work of wiring the bridge for the overhead electric system is being pushed rapidly. Within the city limits the underground trolley system is to be used, and the power will be obtained from the United States Electric Lighting company. At the bridge the overhead wiring will be reached, and this will supply the motive power for the remainder of the way. The power house of the new road will be located at Four Mile Run, and has cost about $100,000. There are two engines, each rated at 750 horse power. One obstacle which had to be met in the construction of the road arose at the point where the underground system is connected with the overhead wires, for within the city the cars will be run with a voltage of 220, while in the country the voltage will be 500. This difficulty has been successfully met, and the officials of the road are satisfied that when cars begin running the operation of the road will be as perfect as anyone can ask.

The completion of the immense smokestack over the works of the Potomac Electric Light company was celebrated recently by the lighting of the 24 50 candle power incandescent lights which surround the top. The effect was beautiful and the light was visible for miles around, giving the appearance more of an immense lighthouse than of a smokestack. President Crosby of the company had the lights placed for show, and his purpose has been fully realized. The stack was constructed by the Philadelphia Construction company. The height from the ground is 215 feet. The stack proper is 200 feet high and consists of 32 sections of boiler steel, each section a fraction over six feet high. On the interior the mass of steel is supported for a distance of 100 feet by a solid brick wall. An iron ladder on the outside furnishes the means of reaching the top. On top of the ornamental coping there is a track and movable chairs, designed for the use of the operator who replaces the incandescent bulbs.

Col. J. M. Wilson has made a report to the chief of engineers of operations on public buildings and grounds during the month of March. Col. Wilson calls attention to the fact that the wires connecting the capitol with the various executive departments pass through the trees on sidewalks and that it was impossible at times during the storms of March to maintain the line in working order. "Either an underground system or a line of higher poles carrying the wires above the tree tops," Col. Wilson states, "is absolutely necessary if this telegraph line is to be maintained." This statement has been repeated in the annual report for the past 10 years, and it is respectfully suggested that something be done about it.

The Columbia & Maryland Railway company has awarded to the Barret & Smith company of Dayton, Ohio, a contract for eight combination motor cars, six closed trailers, eight open trailer cars, and 10 closed motor cars. The cars will be somewhat different from the regular electric cars, in that they will have vestibules at each end, and have lavatories and will have center isles and cross seats. The combination cars will have baggage compartments eight feet long. The cars will be lighted and heated by electricity and may be run at a speed of 60 miles an hour.

Manager Marean of the Western Union Telegraph company has secured a permit to erect 40 new poles on the Metropolitan and Washington branches of the Baltimore & Ohio railroad, between H street and Florida avenue, northeast, but he protested against paying the dollar which is charged all companies for the erection of each new pole. The protest which was made may cause some trouble between the commissioners and the Western Union. The company claims a right to erect poles on all post roads free of charge, and the courts have decided city streets to be post roads. The commissioners go further, and claim that even if the streets are post roads they are under municipal control, and that the company can be charged under the act of April 23, 1892, which says the commissioners have a right to charge for each permit granted to make an excavation on any public street, for the purpose of altering, repairing or extending any house sewer, water main, gas main, or other underground construction. They have asked Attorney Thomas to render an opinion as to whether the act gives them the right to charge for each pole erected under this act, or whether it only applies to excavations for water and gas mains. If he decides in favor of the commissioners, the company may carry the matter into the courts If the company defeats the act other companies may also seek to avoid the payment of the fee, and if they are successful quite a revenue will be cut off from the District, as several hundred poles are erected each year

The Nicaragua canal and the Hawaiian cable questions were considered in the House committee on commerce this week, but no votes were taken on any of the bills The discussion over the Pacific cable question was a very warm one. Two companies, the Pacific Cable company of New Jersey and the Pacific Cable company of New York, are making efforts to secure the government indorsement. Each company has very strong partisans in the committee, and it is possible the matter may end in a deadlock, which, so far as this Congress is concerned, will defeat the cable project entirely. It has developed in the course of the discussion that J. Pierpont Morgan is with James L. Scrymser, the chief stockholder in the Pacific Cable company of New York. Mr. Scrymser is president of the cable company which operates the cable to Cuba and the West Indies under an exclusive concession granted by Congress several years ago. Prominent among the stockholders of the company are Sol. Spalding of Honolulu, Abram S. Hewitt, D. Ogden Mills, Frederick D. Grant, Gen. Wager Swayne of New York and J. J. Hill of St. Paul. This company has secured from the Hawaiian government a concession giving the sole right to operate a cable between the islands of the Hawaiian group. The Scrymser company expects to make its landing at Pearl Island Harbor, where the United States has a naval station, through an arrangement with the Hawaiian government. The personnel of the two companies insures their ability to carry out any contract they may enter into with the United States, and the committee, members of it say, would be well satisfied with either if the other were not in the field. Considerable interest is taken in the progress of negotiations by the Hawaiian Legation, and its representative is present at all the hearings. A resolution was adopted by a vote of 10 to four expressing the sense of the committee to be that the government should aid by a subsidy the construction of a Pacific cable. Neither of the two rival companies was named in the resolution, and no terms were suggested.

The sub-committee of the House District committee has reported a bill providing for the construction of a general system of municipal subways to be under the control of the District. The sum of $200,000 is appropriated to begin the work. The estimated cost, embracing 62 miles, is $539,000. All of the revenues derived from the rentals will belong to the District. The commissioners shall rent the conduits to all telephone and electric light companies desiring to use them. All overhead wires shall be placed in the conduits within 30 days after the passage of the bill. T. I. P.

### Milwaukee, Wis.

MILWAUKEE, April 25.—In the recent municipal campaign, the result being a victory for the Republicans, electricity cut a very large figure. Most of the live issues in fact were of electrical association. The reduction of street railway fares was the most important principle involved. In this respect, strange to say, both the Republican and Democratic parties were agreed, so far as the advisability of a reduction was concerned, but the Democratic platform went further than the Republican platform did. The latter was to the following effect: "We are in favor of lower street car fares. We believe the street railway company should accede to the public demand therefor and sell tickets good for 25 rides for a dollar, or six for 25 cents, and we pledge ourselves to use all just and proper means to bring about such a result." The Democratic plank on this subject read as follows: "We favor the reduction of street car fare to the lowest point that can be sustained by law, and believe that a three-cent fare, with transfers, will, by reason of the great increase of patronage from placing the street car service within the reach of all citizens, enable the company profitably to operate its lines." The Democratic party would probably have made considerable capital out of this question, on account of its more pronounced stand, had it not been that the Republican nominee for mayor, William G. Rauschenberger, was one of the few members of the

old Common Council who did not seem to be under the thumb of the street railway company. It was Alderman Rauschenberger who introduced the resolution looking to the erection of a municipal lighting plant, and he voted in favor of competition in street railway business when the McGann ordinance was pending in the council.

Both parties were likewise pledged to the repeal of the law passed at the last session of the Legislature, by which the street railway company, in lieu of city taxes, was allowed to pay into the city treasury a small percentage of its gross earnings—one per cent. on the first $250,000, 1½ per cent. on the second $250,000 and two per cent. on all the gross earnings in excess of $500,000. This tax is upon the earnings of the street cars alone, and the company claims exemption from paying into the city treasury any percentage of its income from the Badger and Edison electric lighting plants. This act of the Legislature has been pronounced on all sides a taxdodging law, and the political parties simply yielded to a popular clamor when they demanded its repeal. Both of the platforms declared in favor of competition in street railway business, and the Republican platform came out for competition in electric lighting and in telephone service.

Mayor Rauschenberger has made a statement of his views with regard to electrical utilities. He points to the water works system as an example of what can be accomplished by the city in managing public utilities, and says that a fund to establish a city lighting plant can be accumulated by the time of the expiration of the present electric lighting contract in 1900, by withholding from the issue of bonds each year a fixed amount. As to street railway ownership, he says that cannot be accomplished so soon. But all franchises granted in the future should be framed so as to expire at the same time in order that the city may then be enabled, if it wishes to do so, to control the street railway business upon its own terms. He says that he wants to see competition in street railway business and reasonable control by the city of the operation of the street railways. Franchises, so worded as to protect the interests of the people, should be granted to responsible corporations who will guarantee low fares and suitable accommodations.

If the new Common Council is in accord with the mayor-elect, the street railway company is likely to experience more trouble than it did at the hands of the old council. The old council, even, has left some measures that may cause some annoyance to the company. There were introduced in the retiring body at the eleventh hour measures providing for a reduction in fares and to repeal unused franchises. Alderman Thuering, the most determined opponent of the company in the old council, submitted an ordinance providing for the sale of eight tickets for 25 cents, the tickets to be good from 5 to 7:30 in the morning and during the same time in the evening. These tickets are to include the privilege of transferring from one line to another. The same measure provides for the sale of tickets, good at the hours when the other tickets are not good, at six for 25 cents, 12 for 50 cents, and 25 for $1. A fine of from $5 to $25 is provided for each violation of the ordinance, so that if the ordinance were upheld in the courts it would not pay the company to disregard it. Alderman Lindsay introduced an ordinance to compel the street railway company to issue six tickets for 25 cents and 25 tickets for $1. This measure makes no provision for transfer privileges. The fine that it provides is from $10 to $50.

Another important matter that goes over to the new council is the ordinance to allow the Milwaukee & Waukesha Electric Railway company to build into the city. This is the company that bought the Wauwatosa motor line and proposes to extend it to Waukesha and other summer resorts and to make the entire system an electric one. The exact route that the company has selected is from Wells street, beginning at the western city limits, east to Oneida, to Cass, to Michigan, to Sycamore, to Fifth, and thence back to Wells, forming a loop; another line along State street to Twenty-seventh, to Prairie, to Fifth, to Wells; another line along Lincoln avenue, from the western city limits to First avenue, to Sixth avenue, to Clybourn, to Fifth, to Locust, with a branch running along Locust and Folsom place to the Whitefish Bay road, and another branch running on Locust to the western city limits; another line running along Oakland avenue, from the northern city limits to Cambridge avenue, to Brady, to Warren avenue, to Lyon, to Van Buren, to Knapp, to Broadway, to Lake, to Barclay, to Florida and thence to First avenue. C.

## PERSONAL.

The death of Richard Thomas on April 20th, at the age of 68 years, is announced. Mr. Thomas was the president of the R. Thomas & Sons company of East Liverpool, O., and was one of the leading porcelain manufacturers of the country.

E. P. Roberts, M. E., president of the Correspondence School of Technology of Cleveland, Ohio, has been appointed consulting engineer to the architects for electric lighting, power, steam heating, hydraulic and sanitary engineering at the new Ohio state asylum for the insane at Massillon, Ohio—a large institution on the cottage plan.

## TRADE NEWS.

The Okonite company announces its removal to 412, 413, 414 Postal Telegraph building, 253 Broadway, New York. Patrons are requested to note the change in address.

Charles G. Armstrong, the consulting electrical and mechanical engineer, has removed his office from the Auditorium Tower to Suite 1306 and 1307 Great Northern building, Chicago.

The Helios Electric company of Philadelphia illustrates types of arc lamps, for both direct and alternating current circuits, in a recently issued pamphlet. A table of carbons on the last page gives acceptable information.

The Abendroth & Root Manufacturing company, 28 Cliff street, New York city, has closed contracts for the Root improved water-tube boiler for the electric light and power plant of the East River bridge, the new power building and the Electrical Exposition, New York city.

Although the factory of the Commercial Electric company of Indianapolis, Ind., was destroyed by fire on April 20th, the company is now filling orders as usual. A new factory was secured the day after the fire, and on the 22d business was resumed. Such enterprise deserves success.

The Metropolitan Electric company has just taken the agency for the Diehl Manufacturing company of Elizabethport, N. J., and will carry in stock a complete line of the latter's ceiling fan motors. The Diehl Manufacturing company is the oldest manufacturer in the country of ceiling fan motors, and the Metropolitan Electric company is fortunate in securing this agency.

The Electric Appliance company states that it is well prepared for the fan motor season with a very complete line. It still retains the agency for the Meston line of alternating current apparatus. The agency for the celebrated Dayton ceiling and column fan has been secured for this season. The new Acme fan motor manufactured by the Appliance company will also be a specialty this year. It is made in both single and three speed and is a high grade machine.

The board of managers of the Ohio State Reformatory has awarded the Card Electric company of Mansfield, Ohio, the contract for two direct-connected mutipolar generators, capacity 66 kilowatts each, speed 250 revolutions per minute, for use in the Ohio State Reformatory, Mansfield, Ohio, for lighting purposes. The generators will be directly coupled to Ball engines. The competition was quite keen, but the Card machines were selected in preference to all others.

Langstadt & Croswell, the "electrical hustlers" of Appleton, Wis., describe themselves as "manipulators of electrical energy," and announce that they furnish dynamos and motors and electrical goods of all kinds, while also offering their services for the installation of plants, wiring, repairing and general construction work. They refer to testimonials showing how well they have executed important electrical contracts in their vicinity. These facts are set forth in an exceptionally well gotten up pamphlet, which is in itself a credit to the firm.

Anyone desiring a beautiful catalogue—a work of art apart from the merits of the article extolled—should send for the pamphlet on "Ideal High Art Engines" issued by A. L. Ide & Son of Springfield, Ill. It is indeed an example of high art in lithographic work, as the product of Ide & Son is in engine building. The Ideal is celebrated as the automatic self-oiling steam engine, and the new catalogue exhaustively sets forth its merits. The book is of the proper size for a catalogue—six by nine inches—and it should be included among the reference books of every steam user.

Although the General Electric company commenced very early in the present year to experiment on the making of Crookes tubes for producing Röntgen rays, it is only after a long series of careful observations that the company has decided that it is ready to put Crookes tubes on the market. The Edison decorative and miniature lamp department is now ready to supply Crookes tubes of approved sizes and types; very successful results have been obtained with the tubes already made. Experiments are being continued in order that the most improved forms may be within reach of the public constantly.

Speaking of the advantages offered by the International Correspondence School of Scranton, the *American Artisan* says that the faculty of this school has perfected a system of home study in sanitary plumbing, drainage, gas fitting and drawing, electric light wiring and bell work, steam, hot water and hot air heating and ventilation, and many other practical lines, that is thorough, up-to-date and eminently utilitarian. And the same journal adds: "This school lacks only three of the features of our technical colleges. The students are too far apart to haze one another, formulate a college yell, or organize a football eleven."

It is a good thing for the engineer or central station manager to find out all about the Hawley down-draft furnace, which George M. Pullman says is "practically smokeless." He can do this by sending for a copy of the elaborate pamphlet issued by the company, whose general office is at 805-807 Security building, Chicago. The book gives much useful information for steam users, of a general and unbiased character, and contains the following guaranty: "To consume 95 per cent. of the smoke, burning any grade bituminous coal. It will increase the capacity of boiler from 25 to 50 per cent. It will save from 10 to 40 per cent. in cost of fuel. Should our furnaces fail to do as guaranteed, we agree to remove them and replace the former setting at our expense."

The Arnold Electric Power Station company of Chicago has engaged the services of G. F. Wheeler as general sales agent. Mr. Wheeler was formerly general sales agent for the Eclipse company of Beloit, Wis., which manufactured the Williams engines. Later he was connected with the Fort Wayne Electric company in the reconstruction of central stations, and recently he was with the Rice Machinery company of Chicago. Mr. Wheeler is well qualified by ability and experience to fill his new position, and he will undoubtedly prove a decided acquisition to the Arnold company, which is now successfully introducing its system.

W. H. Sills, formerly western sales agent for Eugene Munsell & Co., mica dealers of New York, has severed his connection with that company and will hereafter engage in business for himself with offices at 59 Lake street, Chicago. The business will be conducted under the name of W. H. Sills & Co., who will carry one of the most complete stocks of mica in the West, which will enable them to fill all orders promptly. During Mr. Sills' long connection with the mica interests in Chicago he has built up an excellent reputation among the electrical fraternity, and it is to be hoped that his new venture will meet with the success which his energetic efforts merit.

A valuable feature of the new catalogue of the Lafayette (Ind.) Engineering & Electric Works is the space given to carefully prepared data on "Transmission of Power." The loss in shafting is shown by reliable statistics, and the advantageous adaptations of electric motors are pointed out. Directions are given for computing the sizes of conductors, and the book is closed by an excellent table of "Horse Power Required to Drive Machinery," compiled by Professor J. J. Flather. Great pains have been taken to make this table correct, and it will prove of much value in figuring on the sizes of motors either for individual driving or on the group system.

The Otto Gas Engine Works have issued the following circular: "We think it fair to you, as well as to ourselves, to advise you that we have informed by our counsel, Baldwin, Davidson & Wight of Washington and New York, that the electrical igniter on the gas and gasoline engines of the New Era Iron Works company is an infringement of letters patent of the United States No. 523,828, granted September 11, 1894, to Paul A. N. Winand, and of which we are the owners. We have brought suit in the Southern District of Ohio against the New Era Iron Works company, and propose to protect our right against all makers and sellers or users of engines having upon them igniters covered by such letters patent."

It is announced that the Armorite Interior Conduit company of Detroit, Mich., operating under the patents of J. F. Cummings, president of the company, is now manufacturing a complete interior conduit system, known as "armorite," which is said to be cheaper and better than any other conduit. The iron tubes are made in any size, from three-eighths inch to three inches inside diameter, all in 10-foot lengths, and are lined with thoroughly prepared wood, cut in semi-cylindrical sections and forced into the armor, making very effective insulation. This conduit possesses many advantages, and it is stated that ordinary bends in conduit of a diameter of one inch or less can be made cold on the job by the workman. Mr. Cummings is one of the best practical electricians in the country, and he has spent years in perfecting his system. Price-lists and samples will be forwarded on application to the company at 478-480 Fort street West, Detroit.

The Johnson-Lundell Electric company's "surface contact" railway is now in operation on West Thirty-fourth street, New York. The company has an office at 29 Broad street, New York, and it has issued a description of the system which is worthy of reproduction. "The electric current is transmitted from the power house through an underground, hermetically sealed and highly insulated conductor. This wire parallels the road throughout its length, but is normally out of electric connection with any part thereof. A series of magnetic switches are placed in hermetically sealed boxes at intervals of 16 feet along the entire line; a double series of contact points are set in the pavement of the roadway between the track rails. These switches are primarily actuated by a current transmitted to them by contact between the moving car and the contact points. They, in turn, transmit the power current from the buried conductor to the moving car through the medium of the same contact points. It is thus apparent that these switches must remain closed and the point remain alive so long as the car is drawing current from the conductor that is to say, so long as the contact between the car and point remains unbroken. It will also be

apparent, that, inasmuch as it is the contact between the car and the street point that keeps the switch closed and the point alive, the severance of this contact by the progress of the car must open the switch and the point must become 'dead' and harmless."

A test was made by Jay M. Whitham, mechanical and consulting engineer of Philadelphia, a few days ago at the power station of the Marietta Electric Light, Heat & Power company, Marietta, Pa., with a view to determining the capacity of the Combine boiler in use there. W. Barnet Le Van, mechanical and consulting engineer of Philadelphia, coöperated in the test as representative of the company. The results were very gratifying in every respect. The engineers making the test admit a possible 10 per cent. excess in economy with the boiler running nearer its normal rating, but Mr. Moyes, the inventor and manufacturer of this boiler, is prepared to guarantee an increase of not less than 20 per cent. on boilers of this or larger units of power. The results of the test are stated as follows: Moisture in coal, two per cent.; ash and refuse in coal, 11.13 per cent.; moisture in steam by the Barrus calorimeter, 0.13 of one per cent.; water evaporated from and at 212° F. per pound of dry coal, 9.346 pounds; water evaporated from and at 212° F. per pound of combustible, 10.52 pounds; boiler horse power actually developed, by basis of 30 pounds per hour from 100° F. at 70 pounds pressure, 161.4; rated boiler horse power, 125; horse power developed above rating, 29.1 per cent.; pounds of dry coal burned per hour per boiler horse power developed, 3.69; pounds of wet coal burned per hour per boiler horse power developed, 3.76. This boiler is manufactured by L. M. Moyes, 1434 Randolph street, Philadelphia, Pa.

## BUSINESS.

The Farr Telephone & Construction Supply company of 342 Dearborn street, Chicago, is sending out a new catalogue, which shows that it manufactures magneto bells, extension bells, receivers, induction coils, back boards and everything pertaining to telephones.

W. H. Hubbard, president of the Helios Electric company of Philadelphia, has just completed a new wiring table for Helios alternating arc lamps, from 30 volt transformer and economy coil service. This table will undoubtedly be of great service to users of alternating current arc lamps, as it is believed that nothing of like character has hitherto been published.

The new illustrated catalogue of the Electric Gas Lighting company of 195 Devonshire street, Boston, shows the extent of the business of this company in domestic electrical supplies. This company makes all sorts of electric gas lighters and devotes particular attention to its Samson battery, "the king of open-circuit batteries," of which over 500,000, it is said, are in use in this country.

L. A. Hine has purchased the entire business of the Beardsley Manufacturing company, 234 Lake street, Chicago, and will continue the business of the company under the name of L. A. Hine & Co. The new company has large facilities for turning out brass and copper work for all purposes. The company also manufactures a high grade oil paper for insulating purposes, as well as aluminum castings.

"Current Practice in Protecting Electrical Apparatus Against Lightning" is described by Alexander Jay Wurtz in a recent pamphlet issued by the Westinghouse Electric & Manufacturing company. The value and importance of lightning arresters are shown by a number of letters from central station men, and a diagram of the output of the Westinghouse company shows the growing use of these protective devices.

A neat and well arranged catalogue of electrical materials for use in the insulation of machinery and line equipment is issued by the H. W. Johns Manufacturing company, 240-242 Randolph street, Chicago. The little book is up to date and will be found of much value by street railway men and electrical manufacturers. It describes molded mica and vulcabeston products, electric car heaters and electrotherms.

All the underground cables to connect the Postal Telegraph Cable company's magnificent offices in Pittsburg, through the underground district to the overhead lines outside of the district, were furnished and installed by the Standard Underground Cable company. The cables go out in two different directions, and comprise all the circuits eastward and westward from Pittsburg. The same company is now laying some large underground cables for the Western Union Telegraph company in Pittsburg, taking in most of the western wires of that company, and to replace several non-leaded cables of other makes.

The new "Ballston" type of Medbery overhead railway material illustrated in the WESTERN ELECTRICIAN recently is meeting with great success. The trade generally appreciates the neatness as well as the great strength of this type, while the Medbery insulation is recognized as the highest grade now manufactured. The Mason Electric Equipment company, Chicago, carries a full line of all such material in stock.

The new American turbines are described in a very handsome circular issued by the Dayton Globe Iron Works company of Dayton, O. Recent tests are reported to show the advantages of the New American, which are enumerated as follows: Highest average efficiency from whole to half water, great power for the diameter, steadiness of motion, strength and durability, easy regulation by governor, economy of water.

Fraser & Chalmers of Chicago are sending out a circular setting forth the report of a test made on one of their Corliss engines installed at the De Beers mines in Kimberley, South Africa. At 74.6 revolutions per minute, the engine, which is of the triple expansion type, delivered 223.8 brake horse power, showing a loss in frictional horse power of but 4.4 per cent., while only 12.9 pounds of dry steam were consumed per horse power hour.

The Electric Appliance company states that it is now in a position to quote especially low prices on Paranite cables of extra large carrying capacity up to 1,000,000 circular mils. It is also able to make very prompt deliveries, as the nearness of the Indiana company's factory precludes the possibility of delays in transit. Paranite telephone cables from 10 to 500 conductors are also in large demand, and the Electric Appliance company has secured a number of good orders.

The Detroit & Cleveland Steam Navigation company's steamers are now running daily (except Sunday) between Detroit and Cleveland. When traveling east or west, north or south, it is well to arrange to take advantage of these luxurious steamers between Michigan and Ohio. If you are contemplating a summer outing, write to A. A. Schantz, general passenger agent, Detroit, Mich., for illustrated pamphlet, which gives full information of a trip to Mackinac via the Coast Line.

E. Wertheim, 55 South Canal street, Chicago, reports an excellent business in soft cored imported German carbons, manufactured by the Union Carbon Works, Germany. In spite of the fact that the carbons handled by Mr. Wertheim are among the most expensive on the market, large orders are daily received, and the demand is constantly increasing. Mr. Wertheim carries a stock of over half a million carbons, and is able, therefore, to fill orders promptly.

No material is said to possess so strong an affinity for iron and steel as pure, soft flake graphite, and for bicycle chains and sprockets there is nothing equal to it. The Dixon Crucible company, Jersey City, N. J., selects its choicest material from unlimited stocks, and, after analyzing all other cycle chain lubricants in the market that it could find, does not hesitate to say that Dixon's No. 691 cycle chain graphite is absolutely without an equal for preventing rust and wear of chain and for insuring ease and comfort in riding.

John Gorman, for 20 years practical electrician and dealer in electrical apparatus in St. Paul, will represent the Metropolitan Electric company in handling N. I. R. wire, Metropolitan lamps, "Mac" tape, P. & B. compound varnish, etc. Mr. Gorman is prominently identified in electrical interests in St. Paul and Minneapolis, and has done a large share of the electrical work in that section during the last 20 years. The Metropolitan Electric company is to be congratulated in getting Mr. Gorman to handle its goods.

C. O. Baker, manager of the Chicago office of the Anchor Electric company, reports numerous and encouraging sales of Anchor switches as a partial result of his recent trip. The Anchor snap switches are made in all the standard sizes and patterns. The Anchor push-button switch possesses unique merits. The face plate is solid and neatly finished. The porcelain is of one piece with removable mica sides, thus obviating any liability to fracture through jarring in shipment; it is easy to operate and the make-and-break is quick and thorough. The makeup of the switch in general indicates good workmanship and careful attention to details, which by the way, may be said of all goods of Anchor manufacture.

One of the most enterprising firms in Chicago giving especial attention to the manufacture of all kinds of electric specialties is the Rau Manufacturing company, which has recently moved its plant and offices to the Russell building, corner Randolph and Canal streets. This company has, by long continued effort and careful management, gained the reputation of furnishing the best specialties in the line of sheet metal goods, electrical clusters, flanges, etc., which are carried in stock. The management of this company changed in January of this year, W. J. Frost, formerly superintendent, now having full charge. Mr. Frost has had many years' practical experience in the manufacture of metal specialties, and is constantly on the lookout for the latest and best in the electrical line.

The Cutter Electrical & Manufacturing company of Philadelphia has just issued its new catalogue of C-S flush switches and accessories. This is perhaps the handsomest switch catalogue that has yet been printed; the numerous cuts shown are printed in photographic brown, with the letterpress in an attractive shade of green. Full details are shown as to the interior construction of the switch, and plans for wiring are also given. The switches have so long been before the public that an indorsement is unnecessary, but a short list of some of the users is printed on page 15 of the catalogue, and these names seem to bear out the claim that the C-S switches are the standard for high grade work. The catalogue is very tastefully bound in heavy artists' paper, and the cover is attractively printed in red and black. Ten thousand are now ready for distribution and will be sent upon application.

The Hoppes Manufacturing company of Springfield, Ohio, describes the Hoppes live steam feed-water purifier and exhaust steam feed-water heater in its new booklet. The purifier consists of a round shell of the best boiler steel, having a solid pressed flange steel head riveted in the back end, and a solid pressed flange steel head bolted to a heavy ring on the front end, by studs and nuts. Within the shell are a number of trough-shaped pans or trays, placed one above another, and supported on steel angle ways, fixed longitudinally by means of brackets to the sides of the shell. These pans are formed from thin sheet steel, the heads or end pieces being malleable iron, whereby a very light, strong and durable construction is obtained, and a degree of elasticity or resilience secured to the pans which permits the lime or other incrustations being easily removed. The ends of the pans are higher than the sides, and have projections at each extremity to rest on the ways on which the pans are adapted to slide.

The Walker company of Cleveland has recently closed some very important contracts, showing that the excellent work done by the company in the past year is throwing much of the large and important work into its hands. The Chicago City Railway company has just placed an order with the Walker company for six 800 kilowatt rope-driven generators. These machines will run at a speed of 220 revolutions per minute, and are the largest belt-driven machines in the world. To give an idea of the size of these machines, it is only necessary to say that the rope wheel which drives them is about eight feet in diameter and eight-foot face. Two of these machines will be driven from one engine of the cross-compound type, the engines having each a capacity of 2,500 horse power. After a thorough examination of all the generators manufactured, the Walker company was selected to build these machines because of the excellent performance of its generators now in operation. The Walker company has also received an order for the generators and motors for the first large storage battery road in the world, that of the Englewood & Chicago Electric Railway company, as previously announced in the WESTERN ELECTRICIAN. The Metropolitan Street Railway company of Kansas City also placed an order for a large generator of 1,200 kilowatts capacity, direct-coupled to an Allis tandem compound engine, for the station in Kansas City, the Walker generator being selected after an examination of the various machines in operation in this country. Aside from this the Walker company has received orders during April for a large number of motors and complete car equipments from the following named: Rapid Railway company, Detroit, Mich.; Pittsburg, Crafton & Mansfield Street Railroad company, Second Avenue Traction company, Pittsburg, Pa.; Newburg Electric Railway company, Newburg, N. Y.; Union Railway company, New York; C. E. Loss & Co., Chicago, Ill.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued April 21, 1896.*

558,480. Apparatus for Electrically Working and Welding Copper. George D. Burton, Boston, Mass. Application filed August 11, 1893.

As shown in the cut the invention comprises the combination of the conductors 3+ and 4 connected to the converter, the electrodes 5+ and 6– arranged to bear upon the bar to be heated, the metal electric conducting blocks 10 and 11 mounted on insulating sliding supports arranged to move toward and from the electrodes to clamp the bar to be heated between the contact surfaces of the latter and those of the blocks, and a lever arranged to operate upon the sliding supports to clamp and unclamp the blocks.

558,491. Electric Street Car Motor. Samuel Harris, Cleveland, Ohio. Application filed February 10, 1896.

An electric street car motor having each of its field coils separately detachable with its core from the motor body and the body separable in the plane of the armature shaft.

558,506. Printing Telegraph. Benjamin F. Merritt, Newark, N. J., and John M. Joy, New York, N. Y. Application filed June 29, 1895.

The inventor claims the arrangement of the type-wheel and the worm-wheel mounted on a carriage, a shaft connected to each wheel and to gearing impelled by a motor, an arm on the worm-wheel shaft, pins carried on a lever to engage the arm, an electro-magnet connected by the arm carrying the pins to oscillate the same, and a stationary armature for the magnet.

558,507. Automatic Governing Device for Motors. Benjamin F. Merritt, Newark, N. J., and John M. Joy, New York, N. Y. Application filed June 29, 1895.

The combination with an electric motor, a train of gearing and the shaft to be driven, of a worm mounted upon and secured to one of the shafts of the gearing, a lever having its free end universally movable, a point carried on its free end to engage the worm, a circuit maker and breaker in the path of the lever and connected to terminals of the motor circuit, a spring connected to the lever, a shaft for the lever, an arm secured to the shaft, a pin carried by a disk secured to one of the shafts to engage the arm, and means to start the rotation of the shaft.

558,509. Wire Clamp for Telegraph or Similar Wires. George Middleton, Kirkwood, N. J. Application filed July 31, 1895.

This is a clamp for telegraph and similar wires, comprising a wire bail of sufficient size to loosely slip over an ordinary annularly grooved insulator, the bail being made of a single length of wire and provided with a straight transverse wire connecting the opposite side portions thereof at one end, the opposite side portions of the bail being bent at their point of connection with the transverse wire to form engaging hooks adapted to engage over a line wire and hold such wire in the groove of the insulator without a crimping or bending of the wire, the side portions of the bail adjacent to the hooks being further provided with short inclined

portions, and a straight cam lever provided at one end with a perforated cam head loosely mounted on the rounded end of the bail and adapted to have its nose engage beneath the ridge of the insulator below the plane of the groove in which the line wire is held, whereby the bail will be drawn in a downward direction to lock itself and the line wire on the insulator.

558,517. Regulator for Electric Motors. Oscar H. Pieper, Rochester, N. Y. Application filed January 20, 1896.

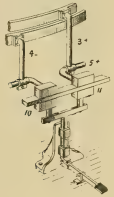
The combination with a shunt wound motor, of a resistance in series with the field magnets, a resistance in series with the armature, and a branch containing a variable resistance between corresponding conductors of the field and armature.

558,518. Handle for Circuit Breakers. William B. Potter, Schenectady, N. Y. Application filed January 15, 1896.

The device comprises a plurality of automatic circuit breakers and an interchangeable handle therefor, removable only when the circuit is open.

558,539. Core for Electro-magnets. Addison G. Waterhouse, Hartford, Conn. Application filed October 16, 1894.

A curved or bent core for electro-magnets, composed of one or more turns or parallel members, each consisting of a thin iron bar or strip rolled or compressed at its outer edge or periphery, and thereby formed to the curve of the core for the finished magnet.




NO. 558,480.

558,555. Electric Guest Call. Simon K. Gimbel, Vincennes, Ind. Application filed December 12, 1895.

Features of this invention are a plurality of switchboards adapted to be placed in guest apartments and respectively comprising a conductive bar and a series of conductive plates separated from the bar, electrical alarms also placed in the guest apartments, a series of push-buttons adapted to be placed in a hotel office, electric connections between the conductive plates of the several switchboards and the push-buttons, electrical connections between the bars of the several switchboards and the electrical alarms, a battery, electrical connections between one of the poles of the battery and the push-buttons, conductors connecting the electrical alarms and the other pole of the battery, means for closing the breaks between the conductive bars and the plates of the several switchboards, a push-button, a conductor connecting one of the conductive plates of the button and the battery, and conductors connecting the other conductive plate of the push-button and the bars of the several switchboards.

558,559. Electric Rheostat or Heater. Harry W Leonard, East Orange, N. J Application filed December 18, 1895.

The combination of a conductor, a supporting body, and a layer of insulating material between the same, and in which the conductor is partially embedded, and which attaches the conductor to the supporting body.

558,564. Electric Alarm System. Charles A. Rolfe, Chicago, Ill. Application filed September 24, 1894.

An alarm system comprising signal transmitting mechanism connected with the main line, and an auxiliary or home circuit for operating the signal transmitting mechanism provided with a bridge, and an alarm operated by a current crossing the bridge.

558,565. Railway Signal. William G. Roome, Jersey City, N. J. Application filed November 17, 1893.

In a railway signal system, the combination of a dynamo, a distribution system extending therefrom, transformers having the primary circuits connected to the distribution system, the secondary circuits being connected to the tracks of the block, and track circuit relays arranged to control the signals of the system.

558,566. Railway Signal William G Roome, Jersey City, N. J Application filed November 17, 1895.

In a railway signal system the combination is claimed of a circuit containing the signal or signals, and a circuit comprising a continuous length of wire arranged near the track of a railway and adapted to be broken or disarranged by a landslide or similar disturbance, thereby controlling the signal circuit

558,573 Apparatus for Detaching Electric Lamp Bulbs Oleny Smith, Detroit, Mich. Application filed October 7, 1895.

In a lamp detacher, a flexible shaft provided with means for engaging the lamp, and means for rotating the shaft.

558,581 Telephone. Stephen D. Field, Stockbridge, Mass Application filed August 24, 1895

In a telephone, the combination with the diaphragm, magnet coil and core thereof of a closed conducting circuit surrounding the core

558,595 Electric Metering System John W Gibboney, Lynn Mass. Application filed March 6, 1895

An electric metering system is described, comprising a number of meters severally connected with supply mains and adapted to operate successively or simultaneously, a number of registers, each directly or indirectly actuated respectively by each of the meters, and a summation register adapted to be operated each time an individual register operates

558,602 Electric Signal for Railway Trains Edward J Devine Schreiber, Canada Application filed July 5, 1895

In a train signal having a series of wires in each car there is a coupling for the wires between the cars composed of two parts or members having interlocking U-shaped plates, to which the wires are connected, and short-circuit closers carried by the parts or members, and having contact portions divided into members designed to fit snug between the U-shaped plates when the parts or members are separated.

558,609. Drop Light Electrolier. George Peeples, Philadelphia, Pa. Application filed December 24, 1894.

One claim follows: The combination with the rigid guide bars of the extensible lamp carrying tube, wires therein extending from the lamp, a block carried by the upper end of said tube, disks on said block having openings for the rigid guide rods, and spring-pressed blocks in contact with the guide rods and electrically connected to the lamp wires.

558,617. Telegraph Key. Walter E. Simons, Dublin, Canada. Application filed September 12, 1895.

Features of this invention are: A spring circuit-closer connected with the front contact point and bearing downward on the lever, a trip lever pivoted to the operating lever and having its rear end pivoted to and insulated from the free end of the circuit closer, and a spring connected to the rear end of the operating lever, and operating to prevent it from rising until the circuit closer has been moved out of contact with it.

558,634. Electric Glow Lamp. Edward A. Colby, Newark, N. J. Application filed May 21, 1894.

The combination in an electric glow lamp of a glass receiver, a closed conductor therein, and an inducing coil, the receiver having diametrically opposite depressions, and the coil being provided with internal points entering the depressions.

558,650. Means for Controlling Electric Currents. Patrick Kennedy, Brooklyn, N. Y. Application filed June 27, 1895.

The inventor claims: In combination with a main circuit, an electrical generator adapted to supply current thereto, a circuit of control adapted to govern the generator, a series of resistance coils connected with a branch conductor of the circuit of control, a series of conductors connected with the coils and terminating at intervals apart in a rotatable non-conducting vessel containing conducting fluid, and a branch conductor of the circuit of control leading from the vessel, an electro-magnetic device included in the main circuit and operated by its current, and suitable mechanical connections between the electro-magnetic device and the vessel, by which movement of the former is communicated to the latter.

558,686. Telephone Trunk Circuit. William H. Hennessey, Chicago, Ill. Application filed February 7, 1896.

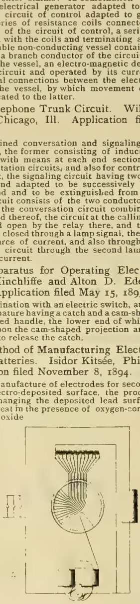
A combined conversation and signaling trunk circuit is described, the former consisting of inductively connected sections, with means at each end section for connection with sub-station circuits, and also for controlling the signaling circuit, the signaling circuit having two lamp signals at the call end adapted to be successively lighted from the calling end and to be extinguished from the called end, which circuit consists of the two conductors of the central section of the conversation circuit combined with circuits at each end thereof, the circuit at the calling end being normally held open by the relay there, and the circuit at the called end closed through a lamp signal, the plug-seat switch and a source of current, and also through a relay adapted to close a circuit through the second lamp signal and the source of current.

558,687. Apparatus for Operating Electric Switches. Daniel Hinchliffe and Alton D. Edes, Plymouth, Mass. Application filed May 15, 1895.

In combination with an electric switch, an electro-magnet and an armature having a catch and a cam-shaped projection, a fulcrumed handle, the lower end of which is adapted to operate upon the cam-shaped projection and depresses the armature to release the catch.

558,692. Method of Manufacturing Electrodes for Secondary Batteries. Isidor Kitsée, Philadelphia, Pa. Application filed November 8, 1894.

In the manufacture of electrodes for secondary cells, having an electro-deposited surface, the process, which consists in changing the deposited lead surface through the action of heat in the presence of oxygen-containing material into a low oxide



NO. 558,650.

558,714. Electric Heating. Charles S. Bradley, Avon, N. Y. Application filed August 22, 1891.

A system of electric heating, comprising a heater and regenerator containing a resistance to be heated by an electric current, a conduit for leading the fresh air to the heater, a pipe for discharging it into an apartment, a pipe for discharging the air from the apartment over the walls of the conduit, an electric motor and two blowers communicating with the induction and eduction pipes.

558,717. Process of Electrically Treating Fabrics for Waterproofing or Other Purposes. Henry L. Brevoort, Brooklyn, N. Y. Application filed July 1, 1890.

The process of treating a fabric electrically consists in moistening the fabric with water, placing it between an anode of an oxidizable metal and a suitable cathode, and substantially in contact with the anode, passing a current of electricity through the moistened fabric, oxidizing the anode and depositing the oxide on or in the fabric.

558,724. Device for Regulating Motive Power. Bradley A. Fiske, U. S. Navy. Application filed September 10, 1888.

The arrangement comprises a body or apparatus movable in divergent planes, a single motor, two separate power connections from the motor to the body or apparatus, each for giving it one kind of movement, and a single universally pivoted arm engaging both the power connections and controlling the same, whereby all the movements of the body are given it by the single motor and controlled by the single lever.

558,727. Electric Stand Lamp. Robert Graves, Irvington, N. Y. Application filed February 25, 1896.

A standard or support, a tubular casing mounted in the upper end thereof, a tube passing through the casing, an incandescent electric light bulb mounted in the tube, conductors which are connected with binding posts in the bottom of the standard or support, and which extend upwardly therethrough, and which are connected with binding posts at the upper end of the tube, and means for making electrical connection with the conductors.

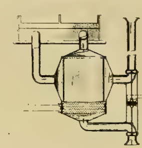
558,741. Trolley. James H. Rabbitt, Wethersfield, Conn. Application filed October 10, 1895.

An electric trolley, consisting of a spring-actuated pole, a bar which is centrally pivoted to the free end of the pole, and two contact wheels which are respectively pivoted to the opposite ends of the bar, and are pressed toward the trolley wire by the action of the spring-actuated pole, in combination with a spring which is located between the pole and the bar, and assists the action of the spring-actuated pole as to one of the contact wheels, and opposes the action of the pole as to the other of the wheels.

558,749. Electrically Controlled Gas Engine or Motor. George L. Thomas, Montclair, N. J. Application filed November 11, 1895.

In a motor adapted to be operated by compressed gas, the combination of a cylinder and a piston therein, an inlet valve is held to its seat by an electro-magnet and opened by the pressure of the gas when the magnet is de-energized, and an outlet valve is also controlled by an electro-magnet.

558,750. Multiple Contact Switch. Elmer H. Wright, Chicago, Ill. Application filed November 28, 1894.



NO. 558,714.

A three-wire system switch comprising a switchboard provided with two sets of terminals of three each, a plurality of contact points arranged upon the switchboard in three electrically connected groups, each of which groups is connected with one of the terminals of one set, a contact carrying member provided with three contact points adapted for various engagement with those of the switchboard, and flexible conductors connecting each of the contact points of the movable member with one of the terminals of the second set.

558,758. Fastening Insulator Brackets. Lauren S. Beardsley, Naugatuck, Conn. Application filed October 30, 1895.

This is an insulator holder or pin consisting of a main portion, having its upper end screw-threaded for the reception of the insulator hood, and its lower end formed with lugs.

558,807. Underground Railway System. Albert G Heinle, Esplen, Pa. Application filed October 10, 1895.

A conduit and a suitably constructed car, having secured to its underneath portion arms engaging a plate, the plate carrying a supporting plate operating through the slot of the conduit, and being constructed with a circular plate on its base and secured to an auxiliary plate are described.

558,858. Railway Block Signal. Frank C. Stevens and James Donovan, Lowell, Mass. Application filed August 20, 1895.

Signal setting devices are adapted to be positively actuated by a passing train to set the semaphore at "danger," and comprise a crank shaft, a weighted wheel fast thereon, a locking pawl for the wheel, a wheel weighted in a less degree than the before-mentioned wheel and loose on the shaft, and adapted to lift the pawl, devices connected to the crank shaft whereby it is actuated by a passing train, and an electric lock for the loosely mounted wheel, which is adapted to release the same when the train passes from the block, and thus release the other weighted wheel and allow the semaphore to return to "safety."

558,859. Telephone Apparatus. Alfred Stromberg and Androv Carlson, Chicago, Ill. Application filed October 9, 1894.

Permanent bar magnets, pole-pieces mounted upon the ends of the magnets between which the armature is adapted to rotate, soft iron cores extending from the ends of the magnets opposite those upon which the pole-pieces are mounted, the ends of the cores lying in proximity and carrying telephone coils, a diaphragm mounted opposite the ends of the cores, and a bar of magnetic material connecting the middle portions of the permanent bar magnets to afford a path for the lines of force and render the magnetic fields of the generator and of the telephone independent and distinct.

558,868. Means for Reversing Trolley Pole Supports. Harlan P. Wellman, Ashland, Ky. Application filed September 17, 1895.

The invention comprises the combination with the pivotally mounted trolley pole base, having a gear wheel, of the pivoted frame, the rack bar supported thereby, means for moving the rack bar, the spring acting on the free end of the frame, the air cylinder on the end of the frame, and the stationary piston therein.

558,869. Trolley for Electric Railway Cars. Harlan P. Wellman, Ashland, Ky. Application filed October 1, 1895.

The combination with an electric railway car, having a pivoted overhead trolley pole, of a pneumatic device for engaging the trolley pole and automatically effecting the lowering of the outer end thereof in the event of the trolley wheel jumping off the wire.

558,870 Electric Railway Car. Harlan P. Wellman, Ashland, Ky. Application filed November 5, 1895

The first claim follows: The combination with an electric railway car, of a revoluble trolley pole base, a trolley pole mounted thereon, a pneumatic pressure device carried by the base for automatically moving the pole, and pipe connections opening into the device and leading through the base.

558,904 Electrolier. August Heck, Philadelphia, Pa. Application filed June 25, 1895

A fixture for incandescent electric lamps is described, comprising a base or stand, having a pair of vertically extended yoke arms, a shade having an annular rim provided with a pair of opposite swivel lugs and a central socket holder, with means to pivotally support the shade by its lugs between the ends of the yoke arms.

# Western Electrician.

EVERY SATURDAY.

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## President C. H. Wilmerding.

For the first time in many years the National Electric Light association is holding its convention in New York this year, and for the first time in the history of the organization a resident of Chicago enjoys the distinction of presiding over the deliberations of that body. This gentleman, C. H. Wilmerding, whose portrait appears on this page, was chosen president of the association at the Cleveland convention in February, 1895. His administration will be remembered because of several important innovations in the policy of the organization and for the advancement that was made under his direction in bringing about an adjustment of the question of rules governing construction and wiring, which had so long occupied the attention of the insurance interests as well as electrical men. This meeting will be the first gathering under the new arrangement of holding only one meeting a year, instead of every six months. Another innovation is the change in the plan of holding an exhibition. Many complaints had been made at former meetings about the inadequate facilities afforded for holding these exhibitions, which have come to be regarded as essential to the prosperity of the association. The solution of the problem which the present administration has reached seems to be favorably regarded by central station men and manufacturers alike; it was the result of careful deliberation and was adopted after thorough consideration of all the interests involved. President Wilmerding invited an expression of opinion from the men most prominently identified with the organization before taking final action in this matter. The cordial support which the enterprise has thus far received and the hearty coöperation which has marked the efforts of the management and exhibitors establish the fact that an exhibition on the scale of the present enterprise was all that was required to restore confidence in the organization and revive general interest in the industry. What has already been mentioned would seem to be enough for one administration to undertake, but it has been found advisable to institute many minor changes in the management in order to bring the association up to the standard which it was believed it should adopt.

It will be noticed that the list of papers and the special features announced for the meeting this year are not entirely in the same line as those of former meetings. It has been a matter of considerable regret heretofore that it has been found difficult to hold the attention of the members during many of the sessions, and on more than one occasion the reading of papers has been attended by a gradual dispersing of the audience. This deplorable condition could partly be explained by the fact that while the subjects of some of the papers were of absorbing interest to engineers they did not appeal so much to the manager or owner of a central station plant. This year it is proposed to provide papers on subjects of special interest to station men. The technical features of the meetings will not be eliminated by any means, but the practical problems that are met in every-day station practice will be given more prominence than heretofore. It will be seen, therefore, that in many ways the New York meeting will be experimental, but it is confidently predicted that experience will justify the change in policy. Those who are acquainted with President Wilmerding feel confident that he would not approve changes that he did not believe would materially advance the interests of the organization. The fact, too, that Mr. Wilmerding is naturally conservative gives additional assurance that the changes have been carefully considered and their effect upon the association closely estimated before their adoption.

PRESIDENT C. H. WILMERDING

This is not Mr. Wilmerding's first experience in official capacity in electrical associations. He has been honored several times by the national association, filling the office of vice-president and occupying a position on several important committees, and in every instance he has acquitted himself creditably and served the interests of the organization faithfully. His work as president of the Illinois state association of central station companies, formed several years ago under the auspices of the national association, was exceedingly valuable to the interests represented. He was identified with the Chicago Electric club, and, in fact, encouraged every movement that gave promise of advancing the interests of the electrical fraternity. Mr. Wilmerding's experience before entering the electrical field was varied and valuable. He was engaged upon several important enterprises as a civil engineer, and the general experience gained in these undertakings has been of considerable advantage in his electrical work. A brief sketch of his early career will doubtless prove interesting at this time.

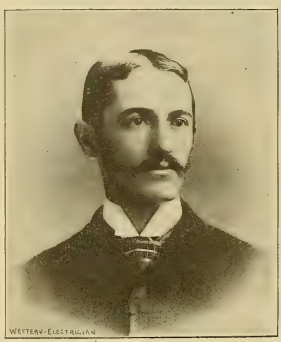
Charles H. Wilmerding is 38 years of age. He was born in New York, where his family has long occupied a position of prominence in the social world. The founder of the family in this country was of German birth. The subject of this sketch, when 11 years of age, was sent to school in Germany. He studied afterward in Switzerland and France until 1875, when he returned to this country and entered the class of '79 at the Sheffield Scientific School, Yale University, taking a course in civil engineering. After leaving college his first practical experience was gained at Troy, where he entered the department of public works and was engaged in the construction of the water works at that place. During this time he took a short course in assaying and metallurgy at the Troy Polytechnic, and then went to Colorado, where he established himself at Leadville. He followed mining and civil engineering for two years, and then went to Utah, where he was engaged in locating lines for the Denver & Rio Grande Western railway, his work being principally upon the main line between Salt Lake City and Denver. He located and constructed a considerable portion of the route between Grand River and Provo. When financial embarrassment compelled the company to suspend operations temporarily, Mr. Wilmerding returned east. About this time he spent a year abroad. He was a member of the party that crossed the Atlantic in the schooner yacht Dauntless and visited England, France, Spain and Portugal, Italy and Morocco. On his return in 1884, he accepted the position of assistant engineer in the department of public works in New York city, and for two years was engaged in locating the Croton aqueduct and the new reservoir in Croton valley. His next professional work was in connection with the elevated extension of the New York City & Northern railway to Yonkers. On the completion of this enterprise Mr. Wilmerding turned his attention to electrical work. He came to Chicago in January, 1888, as the representative of the Electrical Accumulator company, which was then exploiting the storage battery. In November of that year he accepted the position of su-

perintendent of the Chicago Arc Light & Power company and was subsequently elected secretary and treasurer of the company. Later he was made general manager and he continued in that position until the company was consolidated with the Chicago Edison company in 1893. He was appointed general superintendent of the Chicago Edison company and has continued in that capacity ever since.

Mr. Wilmerding's chief characteristic as a business man is the thoroughness with which he enters into the details of any enterprise with which he may be identified and his marked ability for organization. It is safe to say that he is thoroughly familiar with every detail of the operation and construction of the great enterprise in the management of which he is now engaged. It was under his personal supervision that the cables of the Chicago Arc Light & Power company were placed underground and the old station remodeled and rebuilt. There are very few men in the association over which Mr. Wilmerding presides who have had more valuable practical experience than he, and few, indeed, who have so completely mastered the subject of generating and supplying current for electric light and power.

Notwithstanding his numerous business enterprises, Mr. Wilmerding has found time to indulge his liking for athletic sports. He is well informed on current topics, devotes some attention to literature and art and goes into society considerably. Mr. Wilmerding married

Frederic Nicholls, First Vice-President N. E. L. A.




E. F. Peck, Second Vice-President N. E. L. A.

TWO PROMINENT CENTRAL STATION MEN.

Miss Fay of Chicago in 1889, and they have since resided in a fashionable North Side district.

It must be admitted that Mr. Wilmerding does not embody those eager, hustling traits which have come to be regarded as the main characteristics of the successful Chicago business man—outside of this city. Mr. Wilmerding is never in a hurry.

## Two Prominent Central Station Men.

Portraits of two prominent central station men are presented on this page—Frederic Nicholls, first vice-president, and E. F. Peck, second vice-president, of the National Electric Light association. Both gentlemen are prominent in the organization and both are practical central station men. Mr. Nicholls may justly be considered the representative of the Canadian interests in the present management, and Mr. Peck stands for the eastern contingent. A better illustration of the far-reaching influence of the association could not be desired. Canadian central station men and manufacturers have evinced considerable interest in the movement for several years, particularly since the Montreal convention, when they had an excellent opportunity to judge the merits of the organization. Mr. Nicholls is managing director of the Incandescent Light company of Toronto, a corporation operating 30,000 incandescent lamps and furnishing current for 1,000 horse power in motors. The Citizens' Electric Illuminating company of Brooklyn, with which Mr. Peck is connected, is a prosperous concern and operates 3,000 arc lights, 4,000 incandescent lamps and supplies current for motors aggregating a capacity of 500 horse power. Mr. Peck took an active part in the arrangements for the exposition this year.

## Aim and Policy of the National Electric Light Association.

By C. H. Wilmerding.

THE function of an organization such as the National Electric Light association is twofold: instructive and protective. Its value in the first of these depends principally upon the quality of its membership, the capacity of some to impart useful information to others; in the second more upon numbers, for "in union there is strength." The efforts of each succeeding administration in the National Electric Light association have been earnestly directed toward bringing the organization to a higher plane of usefulness in both of these fields, and in the former success has certainly rewarded their efforts. In the latter, though the membership has constantly increased and each year adds a gratifying number to the list, progress has been slower, and from this very fact the benefits of the association have been less far-reaching than they should have been. There seems to exist a lack of appreciation among some managers and superintendents, particularly those connected with the smaller central stations, of the real value to them and to their companies of membership in the association. They do not realize that, although they can stay at home and read in the electrical press a report of the public proceedings of a convention, they are still losing the greater advantage of personal contact and unrestrained intercourse with those whose interests are identical with theirs, and whose experience may be greater, as well as the information which they would obtain through the executive sessions, the minutes of which, for obvious reasons, are not published, but which form the most interesting and instructive part of the proceedings to station men. They lose sight of the fact that in one-half hour's time spent in this way they might acquire a little additional store of knowledge that would save to their companies many times the cost of attendance.

It was more especially with a view to reaching those whom the ordinary proceedings of a convention had failed to interest, that it was decided to add at the nineteenth convention, to be held in New York in May, the further attraction of a comprehensive electrical exhibition—one which in itself would prove a feature of sufficient importance to bring many who had hitherto not been drawn to the association meetings, in the anticipation that when once they had taken part they would so far appreciate the advantages as to become permanent attendants. The success of the exhibition is assured, and the general interest which the coming convention seems to have aroused indicates that it will bear the desired fruit.

The association should, and I trust will, eventually, include a representative of every central station in the United States. The value of such general coöperation is beyond question and the results which could then be obtained for the advancement and the mutual benefit of the members would be still greater than those which already have been and can now be accomplished. During the last year the association has been the means of bringing the electrical and the insurance interests together, with every prospect of effecting a national standard code of rules for electrical installation, the value of which will at once be recognized by all those engaged in the commercial branches of electricity. This is but one example of what can be accomplished by concerted action. The combined efforts of the central station interests in Massachusetts resulted in securing protective legislation of the most important nature in that state, and there is every reason to believe that the coöperation of all the central stations in the country, acting as an organized body, would compel the recognition by municipal and legislative bodies of the rights of property; while at the same time, each benefiting by the experience of the others, all would find themselves better equipped to meet the communistic advocate of municipal confiscation. The National association is already a pronounced success; it requires only the appreciation of this fact by those who are as yet not keenly alive to their own best interests to make it even a greater factor for the good of the industry it was organized to foster.

## Advancement in Electrical Science and Commercial Extension.

By Elihu Thomson.

It is evident that there is an increasing tendency for men engaged in similar business undertakings, or in allied fields of thought and action, to attend conventions or gatherings where matters of common interest or of mutual assistance may be discussed and a general interchange of views be permitted. Ideas are thus spread, new interest kindled, and the best methods are prominently brought out. True progress demands continuous readjustment to changing circumstances, and in no field of activity is this more true than in the commercial development of electric applications. The manager of the electric company in one town, or his subordinates, cannot rest inactive or indifferent when so much depends upon their keeping abreast of the times. Nor can the careful manager provide for the making of trials or experiments in the several lines upon which he may need information. He can, however, through such an organization as the National Electric Light association, be brought into sympathy with his fellows, be kept in touch with the newer developments, and receive a renewed impetus in his particular line of work. It is, of course, impracticable for such an organization to hold frequent meetings at places remote from each other. It is also difficult for the members to be away from their own scene of activity in their busiest and most exacting season. For this reason the annual meeting, held at a favorable time and place, becomes the important event of the year. That the annual meeting of the present year will be marked as one of the most important in the history of the association is evident from the preparations which have been made to that end. Anyone who has matter to present which may be of importance to the central station manager is sure of a respectful hearing at these meetings. The record of the association's proceedings in the past is an enviable one, and there is no reason why in the future a high standard may not be maintained, while the influence of the association may be extended. The idea of connecting the proceedings at the annual meeting with a public exhibition of electrical apparatus and methods is a good one, for although hitherto there have been, during the annual meetings, exhibits of various electrical manufactures, they have been limited by the facilities for making displays and have not been intended to arouse general public interest in electrical progress. There is every prospect that both the meeting and exhibition will be a great success, and that the value and influence of the National Electric Light association to its members will continue in increasing proportions in the future. It must not be forgotten that the enormous advances in electrical science have, in the past, been built upon, and received their encouragement from, the commercial extension of electric lighting and power as exemplified in the innumerable plants throughout the Union—a development which has needed the combination of the results of the best technical skill and engineering with the business talent and energy so much needed in all growing enterprises.

## Manufacturers Benefited as Well as Consumers.

By Edmund Dickey.

I HAVE nothing to offer in the way of suggestions regarding the future policy of the National Electric Light association, except that I hope that they will continue to hold exhibitions, as I believe they are a benefit to the manufacturers furnishing electrical supplies, as well as the consumers. Furthermore, I always enjoy attending the conventions and meeting my professional and business friends.

## The Consulting Electrical Engineer.

By W. M. Stine.

When science suddenly expands into wide commercial applications, marking out new fields and creating new industries, there must needs be confusion for a few years before sound commercial conditions obtain. But it is well to realize, when these early years have passed, that the time has come when success in electrical ventures must follow only from the application of approved and sound business principles. Since the electrical industries are based on perhaps the most abstruse applied science, along with the settling into fixed business grooves there has developed a new engineering profession. The electrical engineer is a modern creation, with his field of practice somewhat hazy when it touches upon the purely mechanical details, yet his profession is entitled to full consideration, for it must become of increasing use to the purely commercial side of electricity. His proper function is too often overlooked, and delayed recognition should be accorded him. These are statements not prompted by sentiment, but forced upon the attention from the dispassionate consideration of the many poorly planned and profit-consuming electric lighting plants and the numerous financial disasters which have brought electrical investments into discredit in the eyes of inconsiderate capitalists.

Those who have had the opportunity of examining many of the smaller electrical plants have been impressed with their faulty construction and disregard of economic details. This is noticeable in the steam plant, the switchboard, the wiring, and, if the alternate current be used, in the size and distribution of transformers. Nor do many of the larger plants make a better showing. This was not so noticeable some years ago, when people were willing pay a high price for the service because of its novelty. Since the business has become a settled one and been thrust on a competing basis with cheapened and improved gas lighting; and this in the face of general hard times throughout the country, the expected reaction has set in to the disparagement of electric lighting. Another factor cannot be overlooked; the cost of producing electrical energy for either lighting or power has by no means cheapened in proportion to the decreased charges for such service. Both arc and incandescent lighting have now reached very nearly their possible perfection, and the disagreeable fact remains that both these translating devices consume too much costly energy for the returns in light units. Add to this that the cost of dynamos, motors, transformers and accessories is still unreasonably high, and we have a condition calculated to make the thoughtful business man cautious before he invests. If the foregoing analysis be not exaggerated, there is urgent need for reform. This should occur along many lines, but the particular phase with which we are now concerned is the recognition of the offices of the consulting electrical engineer. His functions are sufficiently well understood to let them pass without comment.

Established stations need his services. The steam plant should be inspected, looking to higher efficiency and suggested economies. The resulting economy from properly taken indicator cards may alone many times pay for his services. The switchboard instruments doubtless need recalibration, thus increasing the satisfaction the service will give customers. Faults in the dynamos; their improper operation; too great copper losses in the line; bad construction, telling on the coal pile; poor transformers, and too small sizes used; poor carbons in the arc lamps, and wasteful lamps on the incandescent service—these and many other details will repay careful and frequent inspection.

But too much stress can scarcely be placed on his offices in new construction work. Competition is so ruinously fierce that the majority of would-be investors can not distinguish between mere cheapness and the real long-run economy of meritorious apparatus. He is too often the prey of unscrupulous business methods. In short, to place a new electrical station on a sound paying basis demands engineering skill and experience of a high order This applies to every portion of the steam and generating plant and the line construction. But a word about the electrical engineer himself. In such a new profession there must be both unworthy and incompetent practitioners. Here only the man known to be thoroughly competent and reliable should be employed, and at a reasonable figure for his services. Too often cheap service and cheap apparatus are ruinous extravagances.

The National Electric Light association, as the national representative body of the electrical industries, has an opportunity and a duty before it. The duty is to use its influence to place the electrical industries on a sound business basis. The opportunity is the organization of a competent electrical engineering profession. No other body can so well take these needed initiative steps.

## Organization of the Exposition.

When it was determined to hold the nineteenth annual convention of the National Electric Light association in New York city, representatives of the eastern companies at once began to make preparations for the holding of an elaborate exhibition of electrical apparatus, something far more comprehensive than had ever before been attempted in the metropolis. With this in view, a meeting was held at the Murray Hill Hotel on September 10th, at which President Wilmerding, Messrs. Peck, Huntley, Baker, Davis, Markle, Gardner, Redman, Burleigh and Seely were present. A sub-committee was appointed with power to act, and after corresponding with the principal electrical manufacturing concerns in the country and the central station men, it was determined to hold an elaborate exposition. However, as the association was not in position to develop the idea, a company was formed for the purpose of conducting the exhibition. This plan received the sanction of the association officers and was afterward approved by the American Street Railway association. The exposition management has also enjoyed the cooperation of the American Institute of Electrical Engineers, and thus, it will be seen, the enterprise has the unanimous support of the three representative bodies whose members are interested in electrical advancement. When the National Electrical Exposition company was organized the following named officers were selected: President, Harrison J. Smith; vice-president, W. F. Weiss; secretary and treasurer, George F. Porter; executive committee, C. O. Baker, Jr., H. L. Lufkin, R. B. Corey, E. F. Peck, H. J. Smith; general manager, Clarence E. Stump. The stockholders include many central station men, and the enterprise has from the beginning received the cordial support of the national association. In return the exposition company has made a very liberal arrangement by which the association receives $2,000 in any event and a certain percentage of the profits over a stipulated sum. The interests of the organization were carefully guarded and a committee appointed to look after the matter.

HARRISON J. SMITH, PRESIDENT NATIONAL ELECTRICAL EXPOSITION COMPANY.

President Smith, the official head of the enterprise, is a well-known central station man and is one of the most familiar figures at the conventions of the National Electric Light association since its formation. An excellent portrait is presented upon this page. Mr. Smith is superintendent of the Edison Electric Illuminating company of New York. This corporation is one of the largest in the country. It furnishes current for 3,000 arc lights and 218,000 incandescent lamps. It will readily be seen from this that the affairs of the exposition were entrusted to safe hands when Mr. Smith was selected as president of the organization, and the successful manner in which the preliminary work has been done is the best evidence of the wisdom of this choice.

## Conventions and Exhibitions Have an Educational Influence.

By George T. Evanson.

THE electrical people are especially, as a rule, all true Americans and follow the belief of our forefathers, that "in union there is strength," and our strength is our knowledge.

We firmly believe that our National association, through the yearly conventions, is a great educational school, bringing out the views of our fellow-workers in electricity. At these conventions we find members discussing matters of great moment to us all, and here we see our more scientific brothers bring to light the hidden mysteries of the energy that we are all working with, and these discoveries are often of so great importance that we of the electrical world are not the only ones who are benefited by them, but the whole world is told by the reports from these conventions that there has been an answer found for another one of Nature's mysteries. We listen for a moment and then our minds pause and become amazed at the records of what has been done, and inquire what possible achievements remain for the future.

Then the bringing together of the electrical people at these conventions has a most healthy influence upon the trade or profession. It gives a higher moral tone to the business by bringing its members prominently before the public and showing the outsider in a practical way what kind of gentlemen generally compose the electrical associations and the material they are made of. It cultivates a more friendly feeling between the members and imparts invaluable knowledge to them through contact with their neighbors.

Consider the fact of how eagerly the trade papers, containing the detailed accounts of the doings of the conventions, are sought after and read by those who cannot attend the annual meetings of the association. These facts we think are conclusive proofs of the great good that there is in store for the National Electric Light association.

Then the holding of exhibitions in conjunction with the conventions benefits both the engineer and the manufacturer—one can hardly decide which gets the most advantage. One is given practical illustrations of the particular merits of the appliances, for here he sees, side by side, the different wares he has to deal with, and can make his own comparisons, and when he leaves the exhibition hall after the convention it is his own fault if he has not a full knowledge of the relative merits of all the various appliances therein exhibited. We think it is safe to say of the coming exposition that there will be exhibited all the best and standard apparatus now used for the full equipment of electric plants.

The manufacturer is benefited by having the exceptional chance of coming directly in contact with the interested engineer and purchaser and being able, in many cases, to show his appliances in actual operation.

The manufacturers here in Philadelphia, recognizing the great good there is in trade associations, have lately banded together under the name of the Electrical Trades association, and the rapidity with which the other eastern cities are following our example is very encouraging to us as the original association, and we think that the day is not very far distant when all the different branches of the electrical industry will have their associations and will send their delegates to a national convention. We can only say that associations united in this way will form a great and grand institution and will work untold benefits to the followers of electricity. The writer thinks that it lies in the domain of electrical papers to help form such an association, which, he thinks, if once started, would meet with approval throughout the whole country.

## The Exposition Building.

The building in which the electrical exposition will be held is known as the New York Industrial Building. As shown in the cut (Fig. 1), it is an imposing structure fronting on Lexington avenue, extending back to Depew place and occupying the block between Forty-third and Forty-fourth streets. The structure is seven stories high and the special feature of construction which makes it such an admirable place for an exhibition of this kind is shown in the sectional view, Fig. 2. There are on the main auditorium floor 55,000 square

FIG. 1 THE EXPOSITION BUILDING.—EXTERIOR VIEW FROM LEXINGTON AVENUE.

feet of available space. As will readily be seen by reference to the sectional view, the central section of this grand auditorium, which will easily accommodate 8,000 people, is surmounted by a glass dome 65 feet high and containing 12,000 square feet of glass, and its construction is such that it is one of the strongest and most perfect light-giving domes ever built. This makes the hall available for day use, and at night prevents over-heating. The floor is smooth and solid, and the heating, lighting and ventilating appliances are exceptionally fine. The lighting plant of the building, which, as may be judged from the general equipment, is thoroughly modern and of considerable proportions for an isolated installation, as shown in Fig. 3. For obvious reasons a separate building, on the corner of Depew place and Forty-fourth street, is used as a power station. The boiler room is below the street level and is fitted with four return tubular boilers of 150 horse power each and the necessary feed-water appliances. The dynamo room is on the ground floor of the building. The equipment consists of one 300 horse power and one 150 horse power Corliss engine, manufactured by the Fishkill Landing Machine company, Fishkill, N. Y., and one 100 horse power Skinner engine, manufactured at Erie,

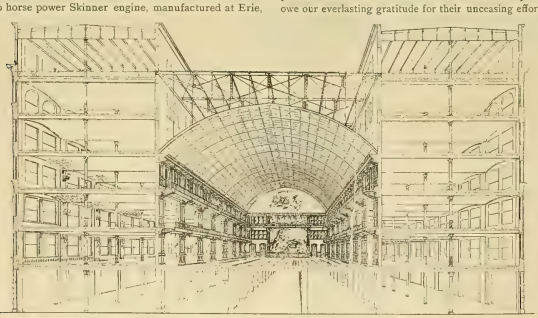


FIG. 2 THE EXPOSITION BUILDING.—SECTIONAL VIEW, SHOWING MAIN AUDITORIUM.

Pa. The 300 horse power engine drives two 80 kilowatt Fort Wayne generators belted in tandem from a counter shaft. Three 45 kilowatt Edison generators are driven by the 150 horse power engine. A fourth 45 kilowatt Edison generator is belted separately to the Skinner engine. The switchboard is of marbleized slate and is equipped with Weston and old type Edison-Bergmann instruments. The mains are carried across Forty-fourth street by underground conduit and taken to the distribution center in the basement of the Industrial Building. The building is also connected with the mains of the Edison Electric Illuminating company, so that in case of accident to the power plant current can be furnished from the central station. The capacity of the plant is 6,000 lamps, but these are distributed over the entire building. The exposition management has arranged for additional current to be supplied from exhibitors' apparatus. Altogether the lighting features of the great show will be the most interesting part of the exhibition for central station men.

The floor plan, shown in Fig. 4, shows the division and allotment of space as arranged by the management.

## Classification of Technical Data.

BY B. J. ARNOLD.

It gives me pleasure to express my interest in the National Electric Light association and to add my testimony to the value of the work it has accomplished in the commercial progress of the electrical business. Peculiar interest has been always attached to the development of the electric lighting industry, both on account of its rapid growth and of its many radical changes. Acting as a safety-valve for many overcrowded lines of engineering and investment, it very naturally attracted to its ranks many of the brightest men in the country. As the business grew, it was not at all strange that those engaged in it early felt the need of an organization of a national character which would bind together their various interests. That the work of the National Electric Light association has been of great value is due, then, primarily to the fact that the organization filled a natural need. At the same time, too much credit cannot be given to those of its members who, by the sacrifice of their time and best thought, have contributed so materially to its powerful influence.

Few men who have not actually passed through the experience appreciate the amount of labor necessary to bring to a successful issue such a meeting as the present gathering in New York. That the work of the programme committees of the past is to be commended can be shown in no better way than by the fact that the reports of the conventions are to be found as works of reference in a large number of offices. Some of the most valuable papers that have been contributed to electrical literature have been read before the association and are second in value only to some of the discussions by which they have been followed.

A successful electric lighting man, be he sales agent, engineer or investor, must keep himself constantly in touch with the various improvements in his particular line of work, and to this end he must use every opportunity which presents itself. To our brothers of the technical press we owe our everlasting gratitude for their unceasing efforts to keep us "up to date," but unfortunately the busy man has but little time to devote to the many valuable articles prepared for his information. Unfortunately, again, adequate descriptions of many striking improvements and of some of the most radical changes frequently fail to find their way into print, and thus the advantages of having a yearly meeting of a national association at which are discussed the most recent phases of development has become more and more apparent.

The highest possible economy in the operation of the central station is the great Mecca toward which most of the members are striving and the papers of former conventions have been replete with information and practical points which have helped them on their way. The programme for this year's convention is certainly one of the best ever offered to the association and is sure to maintain the high standard set in the past. The meeting in New York, given as it is in conjunction with a great electrical exhibition, is sure to instill new life and energy for future work. It seems easy to predict that the association will continue to exert a powerful influence, and, being in the hands of able managers, it is hoped that during the coming convention the social and exhibition features, prominent as they will and should be, will not be allowed to hide the importance of the business meeting, and that a more determined effort will be made to classify the technical data collected, so that the information shall be as available and beneficial to the members of the association as similar information has been to the members of the older and more thoroughly established steam railroad and gas organizations of the country.

## Opening the Electrical Show.

Throughout the arrangements for the great electrical exhibition, the management displayed excellent judgment in securing attractive features that would appeal to the public generally as well as the electrical fraternity. As announced in the last issue of the WESTERN ELECTRICIAN, Governor Morton consented to formally open the exposition, and General E. S. Greeley had already consented to loan for the purpose the gold telegraph key used by President Cleveland at the World's Fair in

OPENING THE ELECTRICAL SHOW.—GOLDEN KEY FIRST USED TO OPEN WORLD'S FAIR.

1893. An excellent half-tone reproduction of this key is herewith presented. The instrument is a very handsome piece of workmanship, is made of solid gold with an ivory finger rest, and on the sides of the handsome plush standard are the dates 1492–1893, as shown in the illustration. A special despach from New York, dated May 1st. says:

"Governor Morton will arrive in New York at noon on Monday and he will be received by President Wilmerding of the association, President Smith of the exposition, and four former presidents of the association—Huntley, Armstrong, Francisco and Ayer—and the reception committee.

"On opening the exposition Monday evening the hall will be dimly lighted. Fluorescent tubes will be arranged about the hall and when Governor Morton touches the key there will be an instantaneous illumination. Grouped in the center of the main auditorium will be the letters N. E. L. A. composed of electric lights and over them will be American flags.

"It has been arranged with the coöperation of the Postal Telegraph-Cable company that when Governor Morton closes the circuit through the key to the power plant, instead of signaling merely from floor to floor of the exposition building, a circuit of 6,000 miles of copper wire will first be made across the continent and back, through Chicago and San Francisco. Arrangements have been made also to fire signal cannon in the same way, at the same time, to announce the event at New York, Augusta, St. Paul, San Francisco and New Orleans."

## Exposition Will Be a Revelation.

BY CLARENCE E. STUMP.

THERE is no doubt that the power and influence of the National Electric Light association is far-reaching and that it will be more so in the future. It cannot but exert a beneficent influence, and the association should receive the active and hearty support of everyone interested in the electrical business. The forthcoming exposition will undoubtedly be a revelation to all who see it, and I feel confident that never before has such a large amount of electrical apparatus, machinery and supplies been brought together. Every effort is being made to make this meeting a red-letter one in the history of the association, and I believe that the attendance will be more than twice as large as at any previous meeting.

## Appointment of Patent Committee Suggested.

By William A. Rosenbaum.

I understand the objects of the National Electric Light association are to listen to and discuss papers upon subjects of special interest, to display and inspect apparatus, to secure an exchange of ideas, promote good feeling and to take such action in general as will improve and protect the business interests of the members. Every line of trade and manufacture in this country is largely indebted for its success to our patent system; this is particularly so of the electrical interests, and is recognized by most commercial organizations in the appointment of "patent" committees and the discussion of questions looking to the amendment or improvement of the patent laws. But it seems to me that the National Electric Light association has developed a spirit of apathy in this direction which is little short of total disregard. So far as I am aware, it, at present, has no patent committee; it has never passed a resolution touching upon the patent system or laws, and there has not been more than one or two papers on this subject read before the association. The reason for this apathy is not apparent, while there are many reasons for action. When several of the fundamental telephone patents expired a few years ago, the diversity of opinion among manufacturers as to what construction of telephone might thereafter be manufactured without infringement was fearful and wonderful; the greatest confusion of ideas existed, and even to-day many are in the dark as to where they stand and are proceeding blindly to put apparatus on the market for which they will have to give an accounting sooner or later. The patent situation in the electric lighting industry is quite as confusing as it was in the telephone industry, and it seems to me that the National Electric Light association might inaugurate a plan at the coming convention which would be of considerable benefit to its members. For instance, a patent committee composed of the best qualified members might be appointed (if one is not now in existence), whose duty, among others, it shall be to keep the run of decisions of the courts affecting electric lighting patents, to prepare a digest of the same in such terms as a layman can understand, adding notes as to the finality of the decisions and such other information as may appear desirable, even to the extent of interpreting the meaning of decisions, where doubt exists. This information should be presented to the convention, and possibly printed for distribution among the members. Then, again, resolutions expressing the sentiment of the association upon the measures now before Congress for the amendment of the patent laws should be adopted and forwarded. Several bills have been introduced, some of which, if passed, will do more injury than good to the present system, and an expression of opinion from an influential body like the National Electric Light association would have its weight with those in Congress who are managing the bills. These suggestions are put forth as being something the association has never considered, it being understood that there are various other lines of work for a "patent" committee.

## Standardizing Incandescent Lamp Sockets.

By F. R. Upton.

THERE is one matter which might profitably come before the national convention, which, from my own experience, I deem very important—that is, the standardizing of the sockets of incandescent lamps. To my mind there is no question that the standard socket should be the Edison. Some 15 years ago standard gauges were sent to England, Germany and France for Edison plugs and sockets, and the Edison plug to-day is the only one which might be considered as international. It is my judgment that two-thirds to three-fourths of all the lamps in use in the world are mounted with Edison plugs.

## Exhibitions Should be Confined to Novelties.

By S. Dana Greene.

IN my opinion the annual meeting of such associations as the National Electric Light association and the American Street Railway association are of great benefit, both to the members of the association and to the trade in general.

I believe that the standards of these meetings have been rising from year to year, and that they are destined to become prominent institutions of the business.

I am frank to say that in my opinion too much prominence has been given in the past to the indiscriminate exhibition of manufactures of all kinds, some of which can only be connected with the electrical business by a very wide stretch of imagination. I believe that such exhibitions distract from the real purpose of the meetings, are a source of unnecessary expense to the exhibitors, and detract from the efficiency and proper conduct of the meeting. I am strongly of the opinion that exhibitions in connection with annual meetings should be confined (under the direction of a special committee appointed for the purpose) to such apparatus and devices of novelty and merit as have been developed during the year, and as are, in the opinion of the committee, of value to the trade.

GOVERNOR LEVI P. MORTON.

## Conventions of Great Value if Not Held Too Often.

By F. E. Donohoe.

Conventions, considered in their proper sense, are, without doubt, conducive to the best interests of the electrical business. The assembling and commingling of the representatives of the different factors which constitute our industry cannot help but to achieve excellent results and redound to the advantage of the trade in general. While the omnipresent supply man fails to enjoy what to him seems to be his merited position as to membership in the several associations, yet it is to his untiring zeal and persistent energy wherein lies the absolute results of the meetings. Conventions may be likened to heroics in medicine, inasmuch as they are of great value when not applied too often.

## Testing Bureau Suggested.

By C. C. Haskins.

The National Electric Light association is to-day the representative body of the electric light and power interests of the United States and Canada. In this character it owes it to itself and to the public before which it is posing as authority to assume the responsibility, as far as possible, of the work done by its members, and through them that of their home constituents. It should enforce its principles and teachings by example as well as by precept, and maintain a high and noble standard of excellence among its disciples. As a parent it should seek to advance the right and check the wrong—indorse the good and chide the evil in electrical practice.

The general public is little versed in the knowledge required for safe electric light and power construction. It is patent to the electrical fraternity that the market is today filled with inventions—"traps"—which, ruled out in the larger cities, are constantly being sold and used in localities where inspection is not required by law; appliances which are sometimes a hazard to life as well as property.

I think the National Electric Light association is capable of exerting a large influence for good by condemning this class of appliances and indorsing those which are commendable.

The Electrical Insurance Bureau has laboratories where tests are made of such merchandise, but their interests are those pertaining to property only. They have said "We do not insure lives."

Let the National Electric Light association organize a laboratory, and equip it for the testing of wires, insulators, cut-outs, switches, etc., and issue a diploma of endorsement for all such as are proven to be acceptable. Make this bureau an integral part of the association, but self-supporting, by charging a fee for the examination and diploma of say, five, ten, or twenty dollars. Let the salary of the expert be a percentage of receipts, and require a detailed report at the annual meeting.

The above is simply an outline. I think this would have the effect of killing off a large list of mischievous appliances which are being used where no expert is at hand to condemn them; and the advantage to a salesman carrying a copy of such a diploma would be invaluable.

Conventions, when the members do not tacitly follow the precepts of an old college society motto, known as F. F. F.—frolic, feed, fluid—may be productive of much good, for no one can mingle with his peers so assembled without learning something useful; and the holding of an exhibition at the same time will lend additional interest to the convention, increase the attendance and the membership, and advance the association as an educator.

## Not Sure that Exhibitions are Profitable.

By Thomas C. Wood.

WE always testify to our faith in the electrical conventions by having a representative attend them, unless prevented by some other urgent business.

The coming May exposition in this city promises to be one of the most successful ever held, and in our opinion no electrical or engine company can afford to neglect the opportunities that it will present. We do not mean opportunities necessarily for making sales, but for enlarging the circle of friends and for renewing old acquaintances.

As to the advantage of expositions in connection with these conventions, we are not sure that they are profitable from an exhibitor's standpoint. The exposition business has been rather overdone of late years, and the standard types of apparatus are already well known. Affording, however, opportunities for introducing novelties, such exhibitions are no doubt excellent.

## Convention a Safety Valve.

By J. McGhie.

I LOOK upon conventions in the light of a safety valve which allows the pent-up feelings of 12 months to escape and gives men an opportunity of meeting on a common ground, where feelings of business distrust and kindred sentiments are, to a great extent, absent. It gives them the opportunity of meeting and discussing matters in a very different spirit from that which is usually present when they are in their own business offices, and accomplishes in a few minutes what months of correspondence would probably be unable to effect.

Regarding the papers read at the meetings, with the facilities which the technical papers offer to all electrical engineers who have important matters to discuss or new things to bring to the attention of their confreres, I believe that the reading of these papers and the desultory discussions which usually follow are comparatively worthless.

Regarding the question of committees and reports the same remark applies here as in the preceding paragraph.

In regard to the question of exhibits, I think they are of great importance to the supply or manufacturing end of the electrical business, which is really the important end, for it must be admitted that the work of experiment and development is not done in the stations, but in the engineering departments of the factories, and there can be no doubt that these exhibitions give the visiting purchaser an opportunity of seeing within a very short time all that is new in the electrical field in the way of supplies and the lesser machinery.

## Occasional Exhibitions Advocated.

By S. M. Hamill.

Personally I am a great believer in this association, as well as in all other kindred associations which bring men together for interchange of ideas.

All the benefits of such an association are not, however, derived from the regular meetings of the associations and the papers and discussions connected therewith. The interchange of ideas and opinions and experiences in conversation, entertainments and intercourse at odd moments outside of the convention hall, are of great benefit to all taking part in them.

I do not believe it advisable to hold an exhibition at every convention, but believe that an exhibition, say once in four or five years, is a most excellent idea and productive of good results.

As to the management of the association, I believe it could not be better.

## Increase in Membership Desired.

By William H. Bryan.

It has occurred to me that it would be a wise policy to make some effort toward increasing the membership from among actual operators of lighting stations More members would be particularly desirable from the smaller plants, which, as a rule, stand in greater need of assistance, as they usually cannot afford to keep experts in their employ. The association should number among its membership a far larger percentage of the total number of stations in this country. Would it not be well also to encourage the attendance at the conventions not only of the executive officers of central stations throughout the country, but also of men in actual charge of the operation of the plants—the superintendents and chief engineers?

It would seem, also, that the time is ripe for a change in the name of the association. It has long since ceased to be a strictly electric light association. The railway and power interests have developed to such an extent, and are so intimately associated with lighting, that the present name is misleading. Would not the National Electrical association be better?

If another suggestion is in order, it would be that the next convention be held in one of the large western cities.

I have a very high opinion of the usefulness of conventions of this character. Their value has been so often demonstrated as to need no argument at this time. The increase of interest in the work, the exchange of experiences, the broadening of acquaintanceships, are all of great value.

I was fortunate enough to be able to take an active part in the entertainment of the association at the convention held in St. Louis in 1893, and feel positive that the influence of that meeting was felt in quite a definite degree in the marked increase of activity in electrical industries which has since been manifested in this city and surrounding territory.

There can be no doubt that the effect of such conventions on trade generally is good. The increased knowledge and experience which come from such reunions cannot help reviving interest and activity in all electrical work. The people who attend these conventions are the men who are looking for better apparatus and supplies I heartily approve of the idea of holding exhibitions in connection with these conventions. They should, however, be very general in character, and not confined simply to supply details. The exhibition should always be secondary to the main objects of the convention, and must not be allowed to outweigh the prime objects of the gathering. The manufacturing interests are beginning to understand that they are expected on these occasions to display their latest and best products.

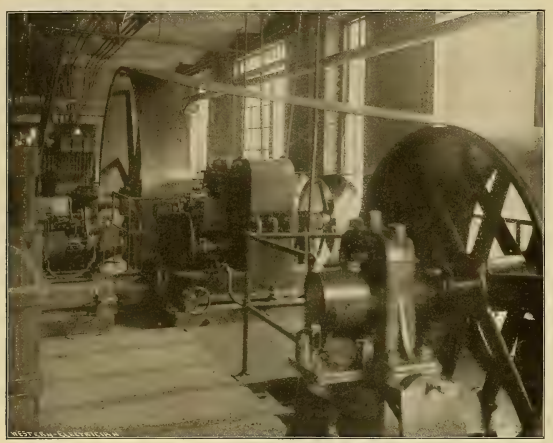


FIG. 3. THE EXPOSITION BUILDING.—VIEW OF POWER PLANT FOR LIGHTING THE INDUSTRIAL BUILDING.

## Exchange of Views Benefical.

By Forée Bain.

Conventions, like "rattlers," smooth the rough corners, polish the surfaces and brighten the entire contents by the rubbing-up-against-each-other process, the effect of one member being to brighten another by contact. A free exchange of thought and experience on the subjects of interest to all cannot but be generally beneficial. The principles of the old craft of "refusing to sow for fear of the birds" is fortunately a thing of the past. One of the first indications of an intelligent man is the freedom with which he is willing to disseminate his knowledge. When conventions are conducted in a manner to promote the true object of their existence, they must be of great benefit, but when they become simply marts for the disposal of goods, the aggregation sinks below the dignity of a convention. I am a hearty indorser of the use of conventions for the interchange of opinions and experience, and for the discussion of methods, although, unwillingly, generally I have been conspicuous for my absence.

## Tendency to Bring About Uniformity of Best Practice.

By Edwin J. Houston and A. E. Kennelly.

No one who has followed the history of the National Electric Light association can fail to recognize the important influence it has exerted on the art of electric lighting in this country. Its conventions have brought together men from all parts of the country thoroughly equipped as regards electric lighting, with that intimate knowledge which comes only from actual practice. Such meetings cannot fail to ensure an interchange of ideas, which tends to bring about a uniformity of practice, and that practice the best of its time.

Instead of each electric light station acquiring its knowledge through a series of expensive experiments, the experience of any one station becomes the common property of all, thus necessarily insuring great economy not only to the members of the association, but also to the community at large.

The tendency to the development of the most advanced practice invariably creates a generous rivalry and enthusiasm, arising from a knowledge of the fact that all results achieved by any station manager will pass in revision before his peers at some subsequent meeting.

## Conventions Improve Business.

By W. R. Mason.

An experience of some seven or eight years has convinced me that the holding of conventions, with the accompanying exhibitions, is of great importance and benefit to the entire trade. I feel confident that the business generally is increased and enlarged by such gatherings. The canvassing of views by practical men from all parts of the country and the exhibition of new devices show new possibilities for advancing the business to supply dealers, capitalists and others interested. Very few of us in this busy country have the time to visit the thousands of lighting stations and railway plants scattered throughout the land, and yet each one of these is studying how best and most economically to operate its business. I have never failed to pick up a number of good points as a result of such gatherings. The exhibition in New York is, in my opinion, a step in the right direction and must be of benefit to all interested in the electrical business. I shall hope to see it followed by a like exposition in Chicago in the near future.

## Official List of Exhibitors.

Following is the official list of exhibitors and the spaces allotted at the exposition, and the exact position of these can be seen by reference to the plan presented on this page. It will be noted that several names in the list are marked R. Such exhibits are on the ground floor and may be classed as part of the equipment of the exposition. The headquarters of the WESTERN ELECTRICIAN at the convention and exposition will be at C 48-49 in the main auditorium. By reference to the floor diagram of the exposition printed on this page, it will be seen that this location is near the entrance to the elevated railroad, Grand Central depot, at the Forty-third street and Depew place corner of the building.

R 292 Abendroth & Root Manufacturing company, New York.
G 183-4 Adams-Bagnall Electric company, Cleveland, O.
J 82 American Carbon company, Noblesville, Ind.
D 140 American Electrical Heating corporation, Boston, Mass.
R 255 American Stoker company, Dayton, O.
J 87 American Watchman's Time Detector, New York.
G 153 Anchor Electric company, Boston, Mass.
B 90 Crouse Tremaine Carbon company, Fostoria, O.
R 267 Curtis Hall Manufacturing company, Hartford City, Ind.
H 118-9 Cutter Electrical Manufacturing company, Philadelphia.
F 140 Dale, Farrell & Co., New York
D 185 De Veau & Co., New York.
Diamond Electric company.
F 118-9 Diehl & Co., Elizabethport, N. J.
F 120 Dyson, Joseph, Carlisle company, Jersey City, N. J.
R 278-9 285 Eddy Electric Manufacturing company, Windsor, Conn.
D 61, 72, 1 Edison Electric Illuminating company, New York.
J 73, 91
J 83 Electric Arc Light company, New York.
D 53, 6 Electric Storage Battery company, Philadelphia.
C 50 *Electrical Engineer*, New York.
C 48-9 Electrician Publishing company, Chicago, Ill.
C 47 Electricity Newspaper company, New York.
H 114, 5 Electrozone company, New York.
E 112 Empire Self-lighting company, New York.
H 111-4 Excelsior Electric Manufacturing company, New York.
E 111, 13, 5
R 261 Eppenwrather & Ladew, New York.
G 152 Ferracute Machine company, Bridgeton, N. J.
B 31 Fiberite company, Mechanicville, N. Y.
B 27 Forest City Electric company, Cleveland, Ohio.
B 23-25, 6, 1 Fort Wayne Electric corporation, Fort Wayne, Ind.
R 286 Fuller & Johnson, Madison, Wis.
R 256 Fuel Economizer company, Matteawan, N. Y.
C 41 Latham, E. B. & Co., New York.
G 16, Lowe Tool company, New York.
Locke Regulator company, Salem, Mass.
D 142 Loomis, R. T., New York.
R 279 Macon Regulator company.
Mechtenberg, A. A., Manufacturing company, New York.
R 251 McKeen, J. H. Manufacturing company, Ridgeway, Wis.
L 96-9 Metropolitan Telephone & Telegraph company, New York.
F 127 Mica Insulator company, New York.
G 156 National Carbon company, Cleveland, Ohio.
National Photograph Machine company, New York.
R 262 New York Belting company, New York.
H 141 New York Carbon Works, New York.
E 120 New York & Ohio company, Warren, Ohio.
R 283 New York Safety Steam Power company, New York.
H 114, 7 Nile Tool Works company, New York.
E 121 Nonconductor Electric company, Cincinnati, Ohio.
C 15 Nuttall, R. D. company, Allegheny, Pa.
R 270 Oakes, Thos. G., New York.
J 72 Okonite company, New York.
Annex Osterheld, M., Columbia College, New York.
G 161 Partrick & Carter company, Philadelphia.
H 29 Pass & Seymour, Syracuse, N. Y.
R 201 Payne, B. W. & Sons, Elmira, N. Y.
R 280 Payne Engine company, Elmira, N. Y.
J 84 Peck Electrical company, New York.
B 22-31-32 Perkins Motor Truck & Wheel company Kingston, N. Y.
D 59 Pennsylvania Slate company, New York.
F 129 Peru Electric Manufacturing company, Peru, Ind.
R 275 Phoenix Iron Works, Meadville, Pa.
Queen & Co., Philadelphia
G 149, 51 Reisinger, Hugo, New York
J 85, Reliance Gauge company.
R 204 Riker Electric Motor company, Brooklyn.
A 3-4 Roebling's Sons, John A., company, New York.
J 88 Russell & Sec., New York.
R 283 Safety Engine.
A 9-12 Safety Insulated Wire & Cable company, New York.
R 260 Schieren, Chas. A., New York.
C 38-40 Schiff, Jordan & Co., Vienna, Austria.
F 139 Schoonmaker, A. V., New York.
C 38-40 Searles, A. M., Chicago.
R 285 Shepard Engine company.
R 259 Shultz Belting company, New York.
R 276 Siemens & Halske Electric company of America, Chicago.
R 264 Simmons, John C., New York.
Smelzer & Co., Nuremberg, Bavaria.
J 86 Spon & Chamberlain, New York.
F 122-4, 1 Sprague Electric Elevator company, New York.
F 132-11
C 38-40 Standard Paint company, New York.
A 13 Standard Underground Cable company, Pittsburg, Pa.
E 100 102 Stanley Electrical Manufacturing company, Pittsfield, Mass.
F 120 Stanley & Patterson, New York.
Stearns Manufacturing company, Erie, Pa.
R 289 Stirling company, Chicago, Ill.
R 277 Straight Line Engine company, New York.
H 138-9 Sunbeam Incandescent Lamp company, Chicago, Ill.
R 288 Taunton Locomotive company, Taunton, Mass.
A 8 Tellmie Manufacturing company, New York.
G 160 Thomson Meter company, Brooklyn.
R 254 Thompson & Bushnell, New York.
G 159 Tucket Electrical Construction company, New York.
C 11-12 United Electric Improvement company, Philadelphia.
R 271 United States Mineral Wool company, New York.
G 158 United States Prism Glass Globe company, New York.
R 265 Vacuum Oil company, Rochester, N. Y.
G 162 Van Nostrand, D. & Co., New York.
J 80-81 Vetter, J. C. & Co., New York.
J 92-3 Wagner Electrical Manufacturing company, St. Louis, Mo.
R 275 Walker Manufacturing company, Cleveland, O.
B 33 Warren, A. K., & Co., New York.
R 282 Warren Electric company, Chicago, Ill.
A 14-15-17 Washburn & Moen, New York.
R 279 Waterous Engine company, Watertown, N. Y.
Wendell & McDuffie, New York.
C 48-9 Western Electrician, Chicago.
L 106-7 Western Telephone Construction company, Chicago, Ill.
L 169 Westinghouse Electric & Manufacturing company, Pittsburg, Pa.
J 89 Weston Electrical Instrument company, Newark, N. J.
R 282 Weston Engine company, Painted Post, N. Y.
Wilkinson, Manufacturing company, Bridgeport, Pa.
A 815 Williamsport Wooden Pipe company, Williamsport, Pa.
B 36-7 Worthington, Henry R., New York.
R 252 Worthington Boiler, New York.
R 286 Woodbury Engine.

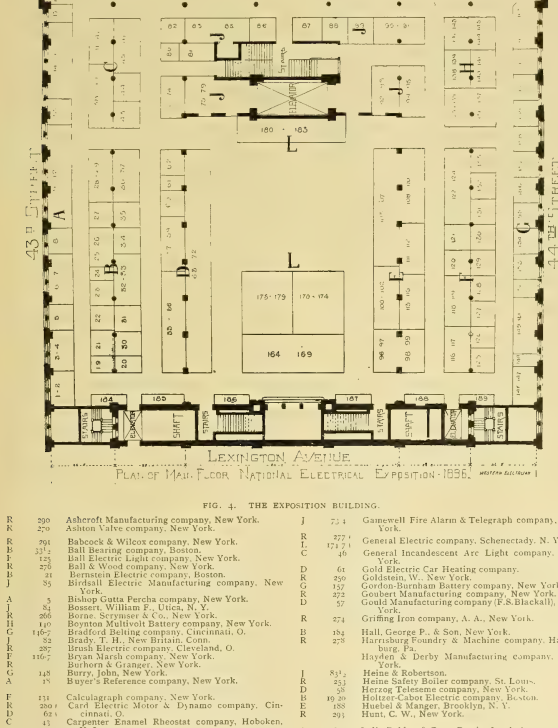



FIG. 4. THE EXPOSITION BUILDING.

R 290 Asheroft Manufacturing company, New York.
R 270 Ashton Valve company, New York.
R 291 Babcock & Wilcox company, New York.
B 32-1 Ball Bearing company, Boston.
J 125 Ball Electric Light company, New York.
R 276 Ball & Wood company, New York.
B 21 Bernstein Electric company, Boston.
J 85 Birdsall Electric Manufacturing company, New York.
A 5 Bishop Gutta Percha company, New York.
J 81 Bossert, William F., Utica, N. Y.
R 266 Borne, Scrymser & Co., New York.
H 140 Boynton Multivolt Battery company, New York.
H 136-7 Bradford Belting company, Cincinnati, O.
J 82 Brady, T. H., New Britain, Conn.
R 287 Brush Electric company, Cleveland, O.
F 116-7 Bryan Marsh company, New York.
R Burhorn & Granger, New York.
G 148 Burry, John, New York.
A 18 Buyer's Reference company, New York.
F 131 Calculagraph company, New York.
R 200-1 Carel Electric Motor & Dynamo company, Cincinnati, O.
D 62, 1 Carpenter Enamel Rheostat company, Hoboken, N. J.
R 284 Case, J. T., Engine company, New Britain, Conn.
B 23 Chapin-Douglas Electric company, New York.
R 251 Clonbrock Steam Boiler company, New York.
J 91-5 Columbia Incandescent Lamp company, St. Louis, Mo.
F 128 Columbia Rubber Works company, New York.
R 296 Consolidated Safety Valve company, New York.
R 267 Cook's, Adam, Sons, New York.
C 46 Corey, R. B., New York.
R 269 Crane company, Chicago.
L 178-9 1 Crocker-Wheeler Electric company, New York
R 253 1
J 73, 4 Gamewell Fire Alarm & Telegraph company, New York.
R 277, 1 General Electric company, Schenectady, N. Y.
C 46 General Incandescent Arc Light company, New York.
D 61 Gold Electric Car Heating company.
R 250 Goldstein, W., New York.
G 157 Gordon-Burnham Battery company, New York.
R 272 Goubert Manufacturing company, New York.
D 57 Gould Manufacturing company (P. S. Blackall), New York.
R 274 Griffing Iron company, A. A., New York.
B 24 Hall, George P., & Son, New York.
R 278 Harrisburg Foundry & Machine company, Harrisburg, Pa.
Hayden & Derby Manufacturing company, New York.
J 83, 2 Heine & Robertson.
R 253 Heine Safety Boiler company, St. Louis.
D 58 Herzog Telesme company, New York.
B 19 20 Holtzer-Cabot Electric company, Boston.
E 188 Huebel & Manger, Brooklyn, N. Y.
R 293 Hunt, C. W., New York.
A 6-7 India Rubber & Gutta Percha Insulating company, Yonkers, N. Y.
Interior Conduit & Insulation company, New York.
B 28 Ironclad Rheostat company, Westfield, N. J.
R 261 Jewell Belting company, Hartford, Conn.
C 51, 2 Johnston, The W. J. company, New York.
R 273 Katzenstein, L., New York.
R 258 Keasbey, R. A., New York.
R 266 Kennedy Valve Manufacturing company, New York.
J 90-1 Keuffel & Esser company, New York.
Kohn, W. A., Chicago.

## National Electric Light Association.

Following is the list of papers to be read before the convention of the National Electric Light association, New York, as approved by President Wilmerding:

*Tuesday, May 5th.*

Acetylene Gas.....L. A. Ferguson.
Single-phase, Self-starting, Synchronous Motors.....F. H. Leonard.
Equalizer Systems of Distribution.....A. Churchward.

*Wednesday, May 6th.*

Results Accomplished in Distribution of Light and Power by Alternating Currents.. W. L. R. Emmett.
Evolution of Interior Conduits: From An Electrical Standpoint.....Luther Steiringer.
Evolution of the Inductor Alternator.... John F. Kelly.
Steam Boilers: Their Equipment and Management.....Albert A. Carey.

*Thursday, May 7th.*

Evolution of the Arc Lamp.....L. H. Rogers.
Electrolysis .....Capt. Wm. Brophy.

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**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.



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THE publication offices of the WESTERN ELECTRICIAN have been removed to much more commodious quarters Our new address is Suite 510 Marquette building, Dearborn and Adams streets, Chicago.

The telephone number remains unchanged—Main 1746.

THOSE who attend the convention and exhibition this week at New York will want to know what those whom they meet there are doing, and those who do not visit the metropolis will no doubt feel considerable curiosity about the proceedings and attendants. For the benefit of both classes—those who attend and those who stay at home—the WESTERN ELECTRICIAN will present a complete report of the proceedings, descriptions of the exhibits, a list of those in attendance and interesting news notes, comments and personal items. It will be an unusually attractive publication and should be read by everyone interested in the association and its work.

IN the lighting of large public and commercial buildings in cities does economy lie in the installation of a private plant or in relying on the larger resources of the central station? This is an old question, and one which depends for its correct answer, of course, largely on such individual conditions as location, heat and power; but still it would be very advantageous, to the consumer at least, to have the benefit of a full, fair and free discussion by experts in modern practice. Perhaps it would be too much to expect the National Electric Light association to go into the merits of both sides of this controversy, since it is made up of men who are of necessity partisans of the central station; yet no one can honestly affirm that the isolated plant has no place in the economy of electric lighting. But the rub comes in defining the limits of that place. In a city like Chicago, where the central station service is systematized and economized to the last degree and where the independent engineers are alert and aggressive, the conflict between the advocates of the two policies is unceasing. One day we are told that a State street merchant has ascertained by actual experience that it costs him more to make current than to buy it, and that he has thrown out his plant and returned penitent to the central station, and the next we hear of a leading hotel proprietor who complains of the size of his monthly bills for light and engages an engineer to design a private plant. And so the warfare is waged, directed by the bright minds on each side, with the advantage seemingly with this party to-day and with the other to-morrow, but with never a conclusion. Probably there never will be a conclusion, with the diverse elements that enter into each case; but a fair statement of the contention—"The Central Station versus the Isolated Plant," under the conditions and practice of 1896—would certainly make very interesting reading. If such a paper were read before the National Electric Light association it ought at least to elicit an animated discussion.

CHICAGO next year! There seems to be a practical unanimity of opinion on this point, and the National Electric Light association will make no mistake in designating this city as the place for holding the twentieth meeting. Many reasons might be advanced in support of this view, but we believe that there is a general desire upon the part of a majority of the members of the organization to hold the next convention in this city. It has been several years since the association enjoyed the hospitality of the Chicago electrical fraternity. The last meeting, which was held in the old Exposition building on the lake front in 1889, was the most successful that had been conducted up to that time, and it is doubtful if any subsequent gathering has been so satisfactory to all interests. In those days, it will be remembered, big exhibitions of electrical apparatus were unknown, but at Chicago there was presented a display that for practical advantages, extent and general interest had never before been approached. The meetings, too, were unusually interesting, and every delegate and visitor felt amply repaid for the trouble and expense entailed. We believe that in the event of the association selecting Chicago for the meeting place next year, the organization will gain considerable strength in this territory. This city is undoubtedly an ideal place for holding conventions, especially when the delegates come from all parts of the country. Its railroad connections are unequaled. Its facilities for accommodating visitors are unsurpassed. The electrical installations in this community will prove valuable object lessons for central station managers and others engaged in construction work and the operation of plants. But there are so many points of interest that it would be folly to attempt to outline them here. And, moreover, we believe it would be wholly unnecessary to do so. Members of the organization have signified a preference for this city as the place for the next annual meeting, and on behalf of the electrical interests of Chicago and the great West, the WESTERN ELECTRICIAN extends to the National Electric Light association a cordial invitation to hold its next annual meeting in the metropolis of the West.

IT is probably too much to expect that our old friend, John Picturesque Barrett, will face the music at New York and give central station men an opportunity to ask him questions upon the subject of management, operation and cost of municipal lighting plants, but despite this fact, there is a possibility that the general topic may be discussed. We suggest that the association invite Alex. Dow, city electrician of Detroit, to give the results of his experience in this line. Mr. Dow will be present at the convention and he has signified his readiness to give his views if they are desired. He objects to being classed as an "exponent of the idea of municipal control of electric plants," and it may be added that he does not consider a city station a cure for all evils in street lighting. We believe that Mr. Dow contends that with careful, intelligent and honest administration a city lighting plant can be conducted as economically as a private corporation. This, of course, is the general theory of all advocates of municipal ownership, but in practice somehow these conditions do not appear to be present. This may be explained by the fact that city officials are not so careful in their expenditures as are the men entrusted with the management of private corporations, who realize that a strict accounting for every penny dispensed by them will be exacted. Then there are other considerations, but it is not necessary to go further into details at this time. Let us hear from Mr. Dow and others representing city plants. We are sure that central station men comprising the association will welcome any person who will tell them how to furnish current for street lamps under the conditions that exist in Detroit to-day for $60 or $65 per lamp per year. That is what Mayor Pingree says Mr. Dow is doing. What has Mr. Dow to say on this subject?

THREE years ago a great exposition, the greatest in the history of the world, was opened at Jackson Park, Chicago, and the feature of that exhibition which attracted more attention than any other was the practical application of electricity to commercial enterprises. It was a revelation to the great throngs that visited the World's Fair; they had no adequate idea of the advancement that had been made or the possibilities of future development which that event suggested. Since that time giant strides have been made, and now the results of experiments and investigations in this field are presented for the consideration of the public in the electrical exposition in New York this month. The management of this exhibition has displayed excellent judgment in the selection and arrangement of exhibits that will show the successive steps in the realization of the present state of perfection to which the art has been brought. In the historical section, in the collection of models loaned by the Patent Office, in the personal exhibits of Edison and Thomson and in the contributions of Cornell University and other institutions of learning, the student will readily recognize the opportunity of a lifetime—one that is rarely afforded and then only to comparatively few—for the study of the evolution of every branch of the science and industry. But this is not all. The practical man, the capitalist whose money is invested in electrical enterprises, and the manager and operator of the central station, the telephone exchange and the telegraph office, will find the latest novelties in their respective lines, the latest productions in the standard types of machines for generating and utilizing power, and thus be enabled to compare the points of advantage in the several types of apparatus found in the market. Those who seek the awe-inspiring and sensational will be gratified by witnessing the model of the Niagara plant operated by current furnished from the great water power and the latest apparatus for producing X-rays. Spectacular and theatrical features will be provided in abundance during the period of the exhibition, from the opening ceremony to the closing exercises. It will be a great show from beginning to end, in every department and in all its details, probably the most remarkable display that has been held in the city of New York, and undoubtedly the most valuable exhibition ever conducted in the metropolis, on account of its scientific value as well as the magnitude of the financial interests represented.

## SEVENTY-TWO PAGES.

### The "Western Electrician" Beats Its Record by Twenty Pages.

The WESTERN ELECTRICIAN conceives it to be no breach of good taste, but rather an announcement of unusual interest, to make especial mention of the fact that in this issue it publishes 72 pages of advertising and exceeds its best previous record, made for the first Cleveland convention issue of February 23, 1895, by 20 pages. This is certainly a remarkable achievement, especially in view of the fact that six pages were received too late for publication, and is of general good cheer as showing, among other things, a gratifying return of confidence in the electrical industry.

But we are especially gratified by, and grateful for, the confidence shown in the WESTERN ELECTRICIAN. This confidence may be ascribed to several causes, but is chiefly due to the fact that the WESTERN ELECTRICIAN occupies a peculiarly commanding position in the field of electrical journalism. Not only is it extensively read throughout every eastern state, where the people are always alert to know what is going on in the great West, the richest buying market in the world, but it brings its patrons in close touch with a great electrical constituency exclusively its own, out of the reach of any other medium. This journal has always made a special point of increasing its circulation, maintaining at all times a high standard of excellence for its readers, sparing neither pains nor money to give the electrical news of all the world first and foremost among its contemporaries. We have yet to hear of a single case where a patron, after thoroughly trying the WESTERN ELECTRICIAN, has ever permanently deserted its columns. Surely there is but one explanation—this advertising brings results, and starts and maintains profitable business relations between seller and consumer.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

| Issue. | Number of Advertising Pages. | Pages of Reading Matter. | Square Inches of Paid Advertising Matter. |
|---|---|---|---|
| March 3, 1894... | 40 | 16 | 4,145 |
| February 23,1895. | 52 | 16 | 5,593 |
| May 9, 1896..... | 72 | 16 | 7,576 |

These figures are carefully and acurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

### Special Features.

There is ample justification for calling especial attention to this number of the WESTERN ELECTRICIAN and the special features which it contains, particularly the excellent series of contributions from men of prominence in every department of electrical science and industry. Experimenters and investigators, inventors and engineers, owners and managers of central stations, manufacturers and dealers in machinery and supplies, constructors and operators, contribute their views and suggestions. It is by far the most representative and comprehensive symposium ever presented by an electrical publication, and we bespeak for it the earnest consideration of the fraternity. It is generally agreed by these writers that the National Electric Light association has done much good in promoting the interests of the electrical industries of the country, but there is not by any means the same unanimity of opinion in the suggestions offered as to how the association can best serve the fraternity in the future. This number of the WESTERN ELECTRICIAN contains 32 portraits of men actively engaged in electrical pursuits and interested in the present exhibition, with many other valuable illustrations.

### The More Members the Greater Benefits.

BY GEORGE A. REDMAN.

The meeting of the National Electric Light association, which is to take place in New York city in the beginning of May, will undoubtedly be one of the best and most important of the kind ever held. This organization should be heartily and enthusiastically fostered by every central station in the United States without a sing'e exception. It has done a great deal for the benefit of the electric lighting industry in the past, and its potency for the future is beyond calculation. The more members we can secure the more benefits will naturally accrue to each one interested. There is nothing the average intelligent man so delights in as an interchange of ideas with his compeers, and I know that I have always derived a vast deal of enjoyment, not only from the general meeting of the association, but from the quiet side talks and trading of sermons incident thereto. I think that each individual member of the association should fee it his bounden duty to as-ist in the success of the coming exposition by not only attending himself, but by also urging the officers, customers and stockholders of his company to attend and see for themselves the enormous strides that are being made every day by the electrical industries of the country. All the indications point to a very fine array of exhibits, which will be instructive and interesting to everyone con ected in the slightest degree with electrical matters.

### Electrical Exhibitions Necessary to Healthy Growth of Business.

BY L. H. ROGERS.

My opinion is that the coming electric light convention in New York will do more to promote the interests of all concerned in the electrical business than any other convention which has preceded this one.

Ideas are somewhat like raindrops; they are plentiful, and scattered all over the universe A convention is like a great lake, where ideas are concentrated, stored and put in concrete form for future use for those who are in a measure dependent upon a reservoir of knowledge for their business life.

The electrical exhibition to be held in the Industrial building in New York in May is one of the best ideas of the decade put in concrete form. It should be perpetuated. It is essential to the manufacturer that there be some place for him to exhibit the result of his money, brains and skill. It is essential to the purchaser that there be some place whe e he can see in actual operation the best products in his line. An annual electrical exhibition in some electrical center is therefore an abso'ute necessity to the healthy growth of the electrical business.

### Origin of the Association.

BY C. C. WARREN.

What do I think of the National Electric Light association? Think of it! Why, what should one think of his own progeny? And have not I, with Terry, Bowen, Sperry, Hummett and Brown, always been jointly accused of the parentage of that offspring? They say "it's a wise child that knows its father," but here's a case where the "kid" is sure—dead certain. It's a queer case of multitudinous paternal ancestry, with no trace of maternity. As neither of the alleged male ancestors has ever been able to prove an alibi or produce a marriage certificate, they long ago agreed to stand pat and allow the motherless thing to confidently assert its legitimacy and take pride in its multiple of male progenitors.

Of course the coovention is a good thing. Hasn't it afforded lots of fun for the boys—given them a great chance to air their wisdom—read papers on the occult, see their names in the electrical journals and return home after a week or so of scientific, bibulous and nicotianine investigation, expanded with the importance of their missions and their contributions to electrical literature? Of course.

But, seriously, much valuable information has in the later meetings of the National Electric Light association been disseminated. While the men of early fame, like Thomson, Weston, Maxim, Edison and Tesla, have not been conspicuous by their presence and hearty support, younger men, more active in details, intensely earnest of purpose, and perhaps none the less scientific, have given to the world through the columns of the WESTERN ELECTRICIAN and other journals the results of their researches, and thus stimulated others to greater activity. The benefits are apparent in the constant and rapid simplification of electrical devices and consequent extension of electrical application. The approaching convention in New York, with its exhibition annex, will doubtless prove to be the most interesting convention held since its inception, nearly a dozen years ago.

### Central Station Men Must Control the Organization.

BY GEORGE CUTTER.

I take pleasure in indorsing most heartily the greater part of the work of the National Electric Light association. We cannot e timate the value of such an association, especially if the active control is kept entirely in the hands of central station men. This feature becomes more and more important as trusts and combinations become more powerful.

The position taken by these combined manufacturing concerns that the central station owner must contract to buy all apparatus and supplies of the combination for a term of years, or else have lawsuits for infringement of patent rights (real or imaginary), can only be successfully met by equally powerful combinations of central station owners.

The expositions are a valuable feature, especially as they have been conducted by the National Electric Light association up to date, viz., a small show, of interest to electric light men, at most of the conventions, with only an occasional grand popular display which helps to build up the trade. My firm convictions are these:

(1) Make the association as large and powerful as possible by recruiting among central station managers.

(2) Keep it entirely and irrevocably in the control of central station men.

(3) Make special efforts to have these central station managers bring their opinions of any dangerous electric trade methods before the convention, to the end that they may be considered on a broad, fair-play basis and then unite with their fellow-workers against all abuse of the power by trusts and other combines.

(4) Hold expositions of particular interest to electric light men at all conventions, with an occasional popular exposition on a grand scale.

### Popular Features of the Exposition.

Probably the most interesting feature of the exhibition for the general public will be the representation of the Niagara plant, accompanied as it will be by the realistic "roar" of the great waterfall. A special dispatch from New York on Friday, May 1st, announced that J. N. Culbertson, the general superintendent of the Bell Company, was in Niagara Falls the previous day, to station a large instrument at Prospect Point at the brink of the American Falls, to transmit the roar of the great cataract to New York city for the exposition. A funnel six feet long will extend from the parapet wall on the point. It will be inclined downward over the falling waters; at the small end the transmitter will be riveted, and the wires connecting it with the metallic long-distance line of the Bell company will be placed underground through the park. Mr. Culbertson is sanguine of success, and says that the roar of Niagara will be heard in New York next week. This will be the first time that such a feat has been attempted.

A collection of over 200 autograph portraits of celebrities of the electrical art and a number of men now rising to prominence or active in the field has been formed by W. J. Hammer. These, in nine handsome framed groups, have been loaned by him to the exposition, where they will be appropriately displayed. The collection not only includes Americans, but is rich in rare photographs of the leading electrical spirits of Europe.

Richard Lamb has worked out a model of the system of electric towage with which his name has been identified, and has placed it on exhibition at the exposition. It will be located as an adjunct to the model of the Niagara power plant, which is to stand in the center of the main floor; and the intention is to run it by some of the stored power from Niagara, switching over occasion-

ally to the regular circuits of the building. The model is no less than 40 feet in length, six feet in height and about three feet wide. The canal will have eight inches depth of water in it. There will be eight poles five feet apart, and a one-quarter horse power motor will furnish a more than liberal supply of motive power to a string of three boats. The latest innovation in canal and lake freighting is the use of steel barges, and the owners of these, the Consolidated Canal company, which now has a large number afloat, has built three small fac-similes of their craft. The model is not strictly to scale, but the boats are. Each is two feet long. They have been named respectively "Hawley," "Lamb" and "Wiman." As a setting to the view of the Erie canal, with its miniature equipment of methods, old and new, a scenic artist has painted an appropriate background of rural scenery. The whole thing is cleverly worked out, the "tow" going up the canal and back in about two minutes, the motor reversing automatically at each end of the section. The Lamb system was described and illustrated in all its details in this journal on November 2, 1895.

The exhibit of the General Electric company consists of a display of arc lamps of the Thomson-Houston series system—alternating current arc lamps, arc lamps for incandescent circuits, and a few examples of the new long-burning arc lamp. Samples of the new Thomson inclined coil measuring instruments and of the pocket ammeters and voltmeters will occupy a place on the tables, together with some of the latest productions of the recording meter department and several of the new alternating current fan motors. A special dark room has been fitted up in which will be made a complete exhibit of all the varieties of incandescent lamps manufactured by the company—the new globular lamps, miniature and decorative lamps, lamps of a high candle power and series burning lamps. Types of apparatus and important installations of the General Electric company will be shown by means of large bromide photographs. The space has been arranged to be devoted principally to the reception and entertainment of visitors. Representatives from the sales offices and departments will be in constant attendance to give information that may be desired, as well as to show the representative operating plants in New York city.

The space of the Brush exhibit comprises 425 square feet. The exhibition will be composed of a historical exhibit and a modern exhibit, the former of which is very old and the latter very new. The historical exhibit will consist of the first Brush arc dynamo, which was sold in 1877 and installed in Baltimore, where it was run for 12 years; a 16 light 2,000 candle power arc dynamo which was run by the Fulton Worsted Mills, Fulton, N. Y., from September 1, 1879, to April 10, 1892, when it was secured for exhibition at the World's Fair, and a 40 light Brush arc dynamo which was operated by the Berkeley company in Providence, R. I., from December 1, 1881, to May 19, 1893, when it was purchased for exhibit at the Columbian Exposition. These dynamos are exhibited just as they left the factory years ago. Not a bobbin of an armature has been rewound or a shaft, wire or commutator replaced. The working exhibit will consist of a new 80 light 2,000 candle power Brush arc dynamo direct-connected to a 60 kilowatt 220 volt motor. Eighty double Brush arc lamps will be hung gracefully around the exhibit and operated from the directly connected dynamo. In connection with the 80 light arc dynamo will be shown in practical operation a machine running with a load of 80 lights with a difference of potential not exceeding 1,500 volts between any parts of the machine or circuits and the machine still maintaining its automatic regulation. To put it more plainly, three circuits will be run direct from the terminals of the dynamo, on any one of which circuits the voltage will not exceed 1,500 volts, or in other words on any one of which circuits there will not be more than 27 2,000 candle power arc lights. This is an entirely new method of running lamps on an arc dynamo and will be exhibited for the first time in the Brush exhibit. There will also be a 100 light 2,000 candle power and a 125 light 2,000 candle power Brush arc dynamo exhibited. These three large arc dynamos are of the very latest Brush type. They have been recently designed by the Brush company, which has already sold over 20,000 lights capacity of the type. A rack of the various styles of lamps which the Brush company manufactures will also be exhibited.

The Joseph Dixon Crucible company, Jersey City, announce that it will have an exhibit of graphite products and carbons of interest to electrical industries at the exposition. The space assigned the company for its display is known as No. 126, section F, main floor.

## Every New Exhibit Brings New Ideas.

By I. E. Storey.

Let the good work go on. Our electrical conventions have proven a great common center of knowledge; the combination of theory and practice. These meetings have been the means of improving and imparting new ideas for the benefit of the whole fraternity. Here the new engineering problems are brought forth and discussed; new inventions are created that go to enlarge the field of electrical industries, which now seems to have an unlimited expanse. Every new exhibit brings new ideas to others, which are developed for the benefit and profit of the public. Through the medium of our associations and conventions the barrier which existed years ago has been broken down, and we are now banded together as one social fraternity. Our street railways, power transmissions and numerous specialties owe a large part of their marvelous growth to the conventions. However, there is a feature creeping into these meetings which if allowed to continue will crush out and obliterate the great benefits which are derived from them. It is the making of our conventions a "commercial fair," a display of merchants' wares and advertising schemes in place of new ideas, new machinery, new engineering problems and new inventions. If these latter features are allowed to be crowded out by commercial greed, we lose the interest and attendance of those who have given their experience and knowledge to the public through these conventions. They should be made meetings for advancement, the exchanging of experience and broadening the many new enterprises of which so many are yet undeveloped.

## General Exhibition Commended.

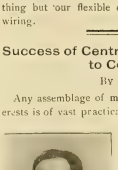
By H. H. Brooks and A. D. Chandler.

We think these meetings or conventions of the electrical fraternity of great value to all concerned, but more particularly to the manufacturer and the supply man. They are of advantage to the former by reason of the fact that he may see what his competitors are doing, and get new ideas as to the wants and requirements of his customers, and their benefit to the latter arises from the fact that he may see what the various manufacturers have to offer to suit his needs, and compare their wares. While the general exhibition hall does not just meet our particular case, there are so many others whom it does suit, that we feel that the National Electric Light association has taken a wise step in that respect this year. Generally speaking, the policy of the association meets our approval. The only suggestion that we have to make as to the future policy of the organization is that it pass a resolution in the near future making it a criminal act to use or specify anything but our flexible conduit in all classes of electric wiring.

## Success of Central Stations Largely Due to Conventions.

By Louis Nahm.

Any assemblage of men having common or kindred interests is of vast practical interest and benefit. The interchange of opinions and information, the reported results of experiments, must necessarily be of much value to all. I think that much of the success of many of the central stations in this country is due in a large measure to the information acquired and the suggestions made at the annual conventions of the National Electric Light association. From the standpoint of associate members, it gives excellent opportunities for renewing acquaintance in the most pleasant manner with the trade, and of forming new trade acquaintances and possible chances of extending their business. These gatherings give us the opportunity of meeting in a few days a large number of gentlemen whom we could not otherwise see, except by the expenditure of a large amount of time and money. For the same reason I think that the exhibition of apparatus and appliances in connection with the convention is of interest and advantage to all, giving the manufacturer an opportunity of displaying his goods under favorable conditions to a large number of prospective buyers, and giving the central station manager the best opportunity of seeing all the latest appliances in a limited space, and thus enabling him in the best manner to judge of their comparative values.



## Convention Acquaintances Have Commercial Value.

By J. H. Rhotehamel.

Such conventions as that of the National Electric Light association are of great value to the electric lighting companies as they afford those attending the advantage of an interchange of opinion on various subjects in which all are interested, and the meeting of those engaged in a similar business must be of great value. The papers read at such meetings are usually able and the discussion brings out interchange of opinions which are the result of actual experience in the line of the subject discussed. Exhibits in connection with such conventions are of value, especially in the introduction of new machinery or apparatus and new devices required by the electric lighting companies. I do not believe it to be of much value for the purpose of disposing of standard goods, except that it enables the supply men to come in contact and become acquainted in a social way with the users of their various lines.

I have been an attendant at the meetings of the National Electric Light association for some few years, and recall with pleasure the many acquaintances I have made there, many of whom have remembered me in a business way after our meeting at this social and business gathering. The coming convention in New York, in connection with the very elaborate exhibition, which I understand is to be made there, will no doubt be of great value to the electric lighting industry.

## Exert a Good Influence on Trade.

By C. O. Baker.

As to the value of conventions I am of the general opinion that they exert beneficial influence on trade in general, stimulate the electrician's desire for knowledge, promote an exchange of ideas that would be impossible through correspondence or the medium of the trade papers, drawing their interests together in such a way that opposing influences may be combatted and beneficial methods adopted, and eradicate the tendency toward conservatism which is so depressing to commercial enterprise.

From the standpoint of the man who has goods to sell, I believe that while the sales made at conventions fall below the expectation of the salesman, the goods for sale are brought more prominently before those attending the convention than by any other means, and conventions as an effective medium of advertising can hardly be excelled.

I do not mean to place myself in opposition to the opinions of newspapers and trade journals on this point, but wish to emphasize the fact that while advertising through the medium of the trade journals is always effective, yet direct examination of the goods and the attention afterward directed to them by advertising in the papers ought, and I believe does, make the buyer more familiar with the goods than he otherwise could be.

Regarding the advisability of holding exhibitions in connection with these meetings, I look on this matter entirely as an advertisement, and, believing, as I do, that unattractive advertising is entirely wasted, I am of the opinion that, in order to make individual exhibits successful, attention must be bestowed on the matter in hand, and the assembling of the exhibits conducted by one whose experience or taste in the matter enables him to judge whether the people are attracted by the display or pass it with "eyes that see not."

As to the friendship and business connections made at these conventions, this is entirely dependent on the individual, and I have formed too many pleasant associations through this means to be oblivious to the advantages obtained thereby.

## This Year's Exhibition to Be on the Proper Plan.

By Frank S. De Rondi.

Our company has for years been a member of this organization, and has been regularly represented at the meetings, which it would not have done had it not felt that it paid to do so. I am strongly of the opinion that the holding of exhibitions in connection with these meetings, at least in the way that they have been held in the past, does not pay the exhibitors. At the same time, I believe that the proposed exhibition to be held in connection with the coming convention in this city in May will be a success, for the exhibits will then be all grouped together in a place where people will come to see them. In former years the exhibits have been held in individual rooms, scattered about hotels and various other places, where they were seen by but few central station men, and I am convinced they did not pay. In my opinion the only way to make an exhibition a success is to have it condensed so that every exhibitor is allowed an equal opportunity for display. We shall always heartily support the association, as well as exhibitions in connection with it, provided they are conducted on the plan that we understand the next one will be.

## Manufacturers and Central Station Managers Exchange Views.

By I. R. Prentiss.

Are conventions and expositions a good thing? For the man who wants to get information and seeks it, the national convention certainly gives him a good field from which to get both sides of the electrical field. The central station man, having had practical experience of years of operation, can give the manufacturer points as to what is best in his particular line. On the other hand, the manufacturer meeting the central station man, can show him how and in what way he has endeavored to meet his wants, and at the same time can be of considerable service to him in giving him full information as to the best possible way of making the station earn the greatest amount of money by seeing that the operators thoroughly understand the apparatus which they operate.

Having attended the conventions, both as a central station man and as one connected with a manufacturing company, I am free to confess that they have, at least in one instance, been of great benefit.

## Exhibitions Add to General Interest and are Profitable to Exhibitors.

By C. O. Baker, Jr.

Conventions generally, I believe, are conducive of a great good to the electrical business generally. I also believe that an exhibition held in connection with the meeting of the National Electric Light association not only adds greatly to the interest in the meeting itself, but proves profitable to the exhibitors. Regarding the future policy of the National Electric Light association, I think that the policy that has been pursued in the past should be continued; that is, to put the association on the highest possible plane, making it so profitable that no one interested in electrical matters can afford to be out of it.

## Beneficial to the Trade at Large.

By George A. McKinlock.

CONSIDERING the question generally, I am in favor of conventions, as I believe that they can be made profitable and interesting in many ways and also beneficial to the trade at large.

Among the most interesting features of a convention are the exhibits of manufacturers who are afforded an opportunity of showing their wares in comparison with other manufacturers, and also having opportunities of illustrating the uses of their goods and answering inquiries and listening to criticisms in regard thereto.

The exhibits of rival manufacturers have a stimulating effect on each other, and a practical engineer in attendance at a convention often is afforded an opportunity of exchanging views with the manufacturer direct, and not through a salesman, as he generally does.

I am in favor of conventions for another reason that is, that they offer opportunities for those in the various fields of electrical work for meeting those engaged in different branches of the business, and their electrical friends generally, in a social way, thereby cementing friendships and keeping alive acquaintances.

## Conventions and Expositions Alike Valuable.

By S. F. B. Morse.

It has been my privilege and pleasure to attend all of the leading conventions and expositions pertaining to the electrical industries and interests for the last 15 years. And, while I have never been able to trace any direct results to these meetings in a business way, I think they have a tendency to create a friendly feeling and fraternalize the business and profession. The student who attends a convention can, by giving close attention to the papers read, learn a great deal, and exchange ideas with prominent men and thereby gain much useful knowledge. A supply man has an opportunity of making acquaintances which in time become valuable, and keep in line with his business. As to expositions, they are useful in the same way that a kindergarten is to a child; that is, one can learn more by seeing the various apparatus than by reading descriptions or studying designs and diagrams. One-half hour given to a machine in actual operation is worth more than a volume written on the subject; so that in reviewing the whole matter, I approve most heartily of both conventions and expositions.

## Exhibitions Are Educators.

By Thomas G. Grier.

First cost should be a minor consideration in comparison with that of the cost of operation. The manager of a central station should know in detail the cost in his plant of producing light, heat and power in its various forms. The National Electric Light association has made these two points apparent to many, and should continue to work along that line In its papers, its discussions and the interchange of ideas between members, it has opened up new fields, new applications, new schemes for the increasing of local business. Many central station men have been greatly benefited by the National Electric Light association conventions, and the trade—that is, the manufacturer and the dealer—have in the end profited. Exhibitions are educators, and while they represent to the manufacturer and dealer much labor and expense, it is difficult for them to determine the net results. They are, however, a most valuable feature at the annual meetings of the electrical men, and should be, and I think are, appreciated by the owners and operators of electric generating plants.

## Ought to Be More Generally Attended by Central Station Men.

By W. S. Rogers.

Do I think the electrical convention a good thing? Yes, indeed. It gives the inventor a chance to show his new inventions, and gives the business public a chance to learn something of the possibilities of electricity. We exchange thoughts and ideas and they help us to keep up with the times. They ought to be more generally attended by central station men. The men who have their money invested, and the men who patronize lighting companies, would do well to accompany the men in charge of the plant and thus get a better idea of the efforts that are made to improve the service and raise the standard.

## Meetings Should be Love Feasts.

By C. S. Knight.

We believe all conventions, if conducted properly, always work out some good. They should, however, be held on the line of a love feast. The president, manager and superintendent of stations should attend such conventions exchange ideas, and have no fear of advancing the same.

To my thinking, there is no body of men in the country that derive as much good by such conventions as the gas people, who know as much of our business today as we do. They are all ready to tell their stories, trials, tribulations and successes, and to help out each brother in business as best they can.

We believe exhibitions in connection with conventions are a good thing, if handled in a moderate way but only the latest and most improved apparatus should be exhibited; this would give owners and operators an opportunity to investigate.

## Exhaust Steam Heating.

By I. H. Babcock.

The utility of exhaust steam as a heating agent is daily becoming better understood, and its value in dollars and cents to the managers of large steam plants is better appreciated with the repeated demonstration on the part of many enterprising concerns who have thus made use of it in connection with established lighting and railway plants.

During the year past this form of enterprise has been adopted by several of these companies with marked success. They find that when the business is fairly developed that the sales of exhaust steam for heating is capable of paying the electric station expenses, in addition to meeting interest on the investment in steam mains; that is, coal bills, water rents, labor account in the station, are all paid by the revenue from the sale of exhaust steam, so that the electric current is put on the wires practically free of cost. It is not necessary to take into account salaries and office expenses, since these must be met from the electric station in any event. While the plan is being adopted by many companies, the wonder is that it is not being more rapidly installed, in view of the great advantages already shown. Competition is so sharp nowadays that economy must be the watchword. The gas companies understand this, and by utilizing waste products are holding their own against electric lighting. If the electric companies could by some new process manufacture current with one-fourth the fuel they now use they would think it a discovery of immense importance and would adopt it without an hour's delay. Here is an equivalent in the opportunity to sell three-fourths of their fuel product, and many of them seem to think it a matter of no account whatever. A management that neglects or refuses to develop the resources at its command shows either indolence or a lack of business comprehension.

In another way the supplying of heat from a station may increase materially the lighting business of the company. The public buildings and business blocks in cities requires three things—first, power for elevators; second, light; third, heat. The building which has boilers for heating will supply its own lights and the power required. If the electric company would heat the building it could also supply it with power and lights. That would afford a complete service to the building and be an additional source of revenue to the company.

## Electricity in Peru.

The South American Light, Power & Traction company of Lima, Peru, has just placed a contract with the General Electric compay of New York for the installation of a 5,000 horse power electrical plant. The dynamos will be erected at the waterfalls 11 miles from Lima, and the electric power generated will be transmitted to the city, where it will be used to operate the surface railways and electric lights and furnish to the public generally such electric power as may be required. This will be, it is said, the largest installation of electricity in South America.

The annual announcement of the Lehigh University at South Bethlehem, Pa., gives information in relation to the department of electrical engineering, which is in charge of Dr. Alexander Macfarlane.

## Magnetic Blow-out Lightning Arrester.

The function of a lighning arrester being that of relieving excessive potential difference existing between electrical conductors and the earth, while preventing the generator current following the track of an electrical discharge from the conductor to the ground, a perfect device is necessary and the path of the lightning discharge must be made easy and direct.

An arrester consisting of an earth conductor brought

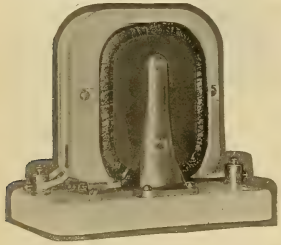
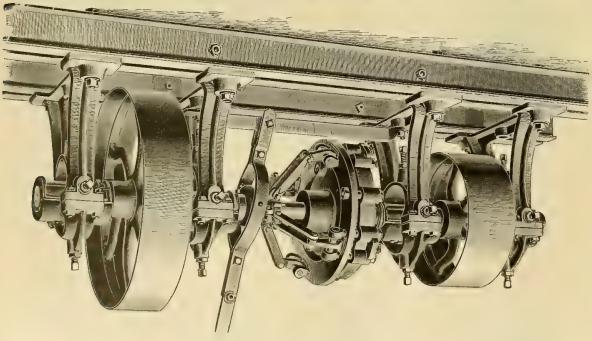


FIG. 1. MAGNETIC BLOW-OUT LIGHTNING ARRESTER.—FOR ALTERNATING CURRENT CIRCUITS.

close to the circuit would suffice, were it not that electrical circuits, however carefully constructed, are likely to have ground leaks, especially in seasons when thunder storms are most frequent. With several such arresters protecting different sections of the line, discharges take place to the earth conductors simultaneously at different points, and under these conditions the generator current is enabled to maintain one or several of the arcs started by the lightning. Should these arcs continue, the arrester would not only be destroyed, but such an excessive flow of current would occur as to bring about also the destruction of the generator or other apparatus.

To render such a contingency impossible, Prof. Elihu Thomson devised a lightning arrester in which two or more discharge points are separated by air gaps, one set being connected with the line, the other with the earth. The main set of discharge points, being placed between the poles of an electro-magnet, is subjected to strong magnetic influence when the magnets are energized. Thus, when an arc is formed between the spark gaps, the magnets are energized and it is lengthened out by the magnetic influence until it can no longer be maintained. As the magnetic influence is instantaneously exerted, it follows that the arc is immediately blown out.

The Thomson magnetic blow-out arresters for direct



IMPROVED WORRALL FRICTION CLUTCH SYSTEM

current circuits, whether constant potential, arc, incandescent, railway or power work, have been already described in these columns. The latest arrester for alternating current work is known as the type L and is a development from the well-known type F. It is designed for circuits of 1,000 to 3,500 volts and its construction can be readily understood from the illustrations. The blow-out magnets have no core, and consist of flat coils placed one on each side of a number of spark gaps, each opening into a porcelain chamber formed by ridges on the inner side of the plates, on the outer side of which are the coils. The gaps are placed in series, and being located at the bottom of the chute, the arc is drawn to the top of the arrester and lengthened by the magnetic field until it can be no longer maintained. In the 1,000 volt arrester, shown in Fig. 1, the arc is drawn out to a total length of three feet. For higher voltages the number of chutes is increased.

This arrester has been especially designed for use on multiphase circuits from which motors are operated, the requirements being more severe than in ordinary lighting practice. It has already been installed quite extensively in some of the most important plants in the country, effectually performing the duties for which it is designed.

## Spencer Long-distance and Interior Telephones.

The Spencer Electric company, manufacturer of high grade telephones at 163 Greenwich street, New York, occupies a leading position in the making of all kinds of interior telephone work. In appearance its telephones are unique and artistic, as shown in the picture, no expense being spared to make them reliable and up-to-date. Old methods of operating the instrument have been replaced by new ones, and, with this type of telephone, but one move is required to get communication with another station.

Interior telephone systems have suffered for want of some simple method of operating them, by which one would not have to make three or fourmoves to get the con-

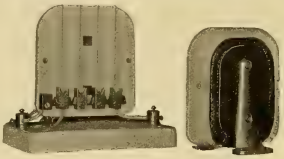


FIG. 2. MAGNETIC BLOW-OUT LIGHTNING ARRESTER.—INTERIOR CONSTRUCTION.

nection wanted and avoid the tendency to pull out a plug or turn a switch to some unknown point that places the telephone again in order for another call. The Spencer company now claims to manufacture a larger variety of interior telephones than any other concern, and it is constantly filling orders for special designs, to which it gives especial attention.

The long-distance telephone manufactured by this company is said to be the best that can be made. It is attractive in appearance, while much can be said in praise of the carbon transmitter, which seems to be, after all, the vital point of a telephone, and one where skill and experience alone can compete.

The Spencer desk telephone has been very successful, owing to its simplicity of operation and talking qualities. Special applications of telephones to certain kinds of work, which heretofore have been somewhat neglected, have been made by the Spencer company in submarine work and steamships. The application of telephones for submarine work has been unsatisfactory heretofore, but the Spencer instruments have overcome some of the most serious objections, and to this company must be given the credit. For hotels and apartment houses this company has entirely new systems and new designs in telephones especially adapted for the severe work required in places of this kind.

In the installation of interior telephone systems bids are asked, and too often the contract is given to the lowest bidder without a specification and without knowing what is to be received. The telephones may work well for a week or a month; then trouble of different kinds is likely to follow fast, until the instruments are

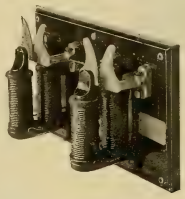


FIG. 3. MAGNETIC BLOW-OUT LIGHTNING ARRESTER.—FOR CIRCUITS OF 100 ARC LAMPS OR MORE.

thrown aside and the old speaking-tubes dusted out to renew their whistling and ear-splitting calls. This could all have been avoided had the system been installed by a reliable firm, with a reasonable guarantee and specifications that would enable the customer to know what he was going to buy.

The Spencer Electric company has an exhibition of its telephones at its store and cordially invites the public and visitors to the convention to call and inspect the instruments.

## Improved Worrall Friction Clutch System.

In the accompanying engraving is shown a patent friction countershaft, with improved Worrall cut-off coupling and ring oiling hangers, mounted on iron bed-

SPENCER INTERIOR TELEPHONE.

plate. This system, which is manufactured by the American Tool & Machine company of 302 Federal street, Boston, Mass., has created a place for itself among power users as being exceptionally simple, reliable and effective in the mechanical transmission of power.

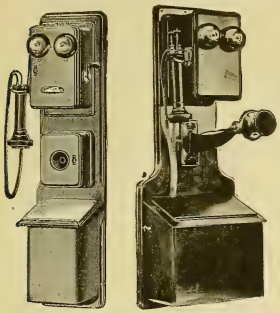
The arrangement shown does away entirely with loose pulleys, as all pulleys are fast on the shaft, which, running in ring oiling bearings, makes frequent oiling entirely unnecessary. The action of the clutch, which is self-centering, is such that all undue slipping of belts is obviated, and a further saving of power is effected, as no power is required to drive belts. Owing to the reliability of this clutch, the arrangement of a quill running in separate bearings, carrying a pulley, makes the best arrangement for heavy work; and it has been applied satisfactorily on power station work. This clutch works equally well on high or low speeds.

The company making this system—the American Tool & Machine company—has an experience of 50 years and has one of the largest and best machine shops in New

England. It has able management, skilled mechanics, does good work and does it promptly. It is known to the trade as an extensive manufacturer of shafting and heavy machinery, and deserves a largely increasing trade throughout the West.

## The Phœnix Telephones.

The company manufacturing the telephones herewith illustrated, the Phœnix Interior Telephone company of New York, has found it impossible to keep up with its orders at the old location, 131 Liberty street, despite the fact that a quantity of new machinery has very recently been added to the plant. It has, therefore, found it necessary, in the attempt to catch up with the business on hand, to remove to larger quarters, where still more machinery can be used to advantage. The company has taken a much larger factory at 108 Greenwich street, New York, and with an increased factory force and additional machinery, the capacity of the plant is now double what it was a month ago. It is hoped that from this time forward the company will be enabled to ship its goods upon receipt of orders. In addition to the largely increased factory space, the company has taken a fine store at corner of Liberty and Greenwich streets, where it is proposed to carry a full line of electrical supplies, in addition to "the best telephones on earth." While the delay in filling orders has been somewhat embarrassing, both to the company and its customers, the demand for the company's goods is certainly a very excellent indorsement of the quality and workmanship of the product.



FIGS. 1 AND 2. THE PHŒNIX TELEPHONES.

In addition to its regular Blake transmitters, of which it makes and sells a great number, the Phœnix company is now making a granular carbon transmitter, which is claimed to be superior to anything of the kind now on the market. It is simple in construction, needs no adjustment, and can, therefore, it is claimed, never get out of order. The Blake transmitter is as good a transmitter of speech as can be devised, but it has the drawback that a person unacquainted with telephones cannot always adjust it correctly, and when the Blake is out of adjustment it is practically useless.

Perceiving the demand for a telephone which can be handled by anyone, which needs no adjustment, and which at the same time will not require so much battery power as the carbon transmitters now on the market, the Phœnix company has devised this entirely new granular carbon transmitter, which embodies all these features. It is adjusted in the manufacture and requires no further attention. It is said to be as sensitive as a Blake and as powerful as a solid-back, and for ordinary short distances will work with only one cell of battery; for long distances, two or three cells are required.

The cuts shown will illustrate some of the styles of instruments. Fig. 1 shows the regular single-battery box, Blake style telephone. The carbon transmitter can be mounted in the Blake box for those desiring this style of transmitter, in which case two cells of dry battery would be required, as the single-battery box will not hold two wet batteries.

Fig. 2 gives an idea of the long-distance telephone (No. 9) "par excellence" for exchanges where the very best of everything is desired. It is the regular gooseneck pattern long-distance telephone, with japanned iron arm, nickel-plated transmitter cup, hard rubber mouthpiece and two-cell battery box, with which the telephone public in large cities is already so familiar. It is strictly up to date in every particular, and, it is claimed, embodies everything that is best in the telephone art up to the present time.

Fig. 3 (No. 10) represents the same telephone as in Fig. 2, only the long-distance transmitter is mounted in a Blake pattern box instead of a nickel-plated cup. In every other particular it is the same, and commends itself to many on account of a slight difference in price.

This company sends telephones to any reputable dealer or exchange in the country, and all it desires is a trial, as it is convinced that it has the latest transmitter in the market and that a trial pair will prove so satisfactory that further orders will surely follow. Anyone buying apparatus of the Phœnix company and for any reason being dissatisfied with his purchase, may, within a reasonable time, return the goods, and the money will be cheerfully and promptly refunded.

## New Wirt Switchboard Instruments.

Queen & Co. of Philadelphia announce that they have gotten out and are ready to put on the market an improved form of the already well-known Wirt switchboard ammeters and voltmeters. In its essential features no alterations have been made in the new instrument. It differs from the old most conspicuously in the size and appearance of the case, which is made entirely of iron and is nine inches in diameter. The lettering on the front is raised and nickel-plated on a black background. In addition to this, all instruments are made dead-beat, a feature which much enhances their value. The arrangement making them dead-beat is a form of air damper and does not at all increase the friction of the moving parts. The other changes are in matters of detail and are the result of a long experience in the manufacture and standardization of electrical instruments.

NEW WIRT SWITCHBOARD INSTRUMENTS.

The new instruments will be covered by a guarantee both as to their accuracy and mechanical construction, and will be placed on the market, it is promised, at a lower price than any others of equal grade. They can be furnished of any desired range and for either alternating or direct current circuits.

The Bell company has succeeded in getting control of the Alabama Telephone company in Selma, Ala.

## Walter K. Freeman Under Sentence.

Walter K. Freeman, well known to the electrical fraternity, who was convicted in New York three weeks ago of abducting 15-year-old Sally E. Work, was sentenced to 10 years imprisonment on April 28th by Judge Newburger. Judge Newburger said that on inquiry he learned that the accused man deserved no mercy, on account of his past misdeeds. Justice Smyth, in the Supreme Court, granted a stay of execution of sentence in the case of Freeman. The stay was granted pending an appeal for a new trial.

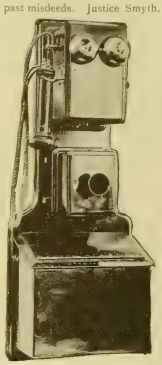
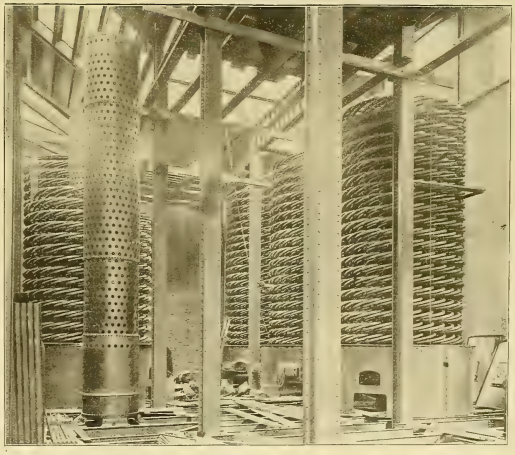


FIG. 3. THE PHŒNIX TELEPHONES.

## Modern Steam Plant.

The Clonbrock Steam Boiler Works of Brooklyn has recently installed a plant for the United Electric Light & Power company of New York, located near the foot of East Twenty-eighth street, which will attract attention from the visiting delegates to the electric light convention on account of a number of special features included. This plant has a capacity of 20,000 horse power, and occupies a very small portion of the large station, which is 98 feet wide by 161 feet long, and consists of 12 Climax boilers, which are partially shown in the accompanying illustration. It is claimed that this installation gives one of the greatest horse power productions for the size of the space of any electric light or power plant in this country. It is stated that the Clonbrock Steam Boiler company has nearly 45,000 horse



MODERN STEAM PLANT.

power installed in the immediate vicinity of New York, and it reports that it is rushed day and night to fill the orders which have been secured since January 1st.

## Special Steam Plant at the National Electrical Exposition.

In presenting to the public an exhibition of electrical machinery and appliances which includes practically everything of consequence in this line, the National Electrical Exposition company decided that such an exposition would not be complete without a steam boiler plant up to date in every sense of the word, whereupon a special committee was appointed to secure a strictly modern plant which would include only the latest appliances in the market.

The improved Root water-tube boiler, manufactured by the Abendroth & Root Manufacturing company of New York, was selected to furnish the steam used at the exposition, there being two equal units forming one battery of 500 horse power of boilers. The well known anthracite automatic stoker manufactured by the Wilkinson Manufacturing company of Bridgeport, Pa., was selected to handle the coal supplied to the fire. The coal, after being dumped at some distance from the boilers, in the rear, is taken by a C. W. Hunt coal conveyor and carried along the side and a little past the front of the boilers, where it is elevated to a point near the ceiling, whence it is delivered through tubes to the hoppers of the Wilkinson stokers, and, of course, from that point it is fed uniformly down the incline grates, burning on its way and reaching the foot of the grates as ash, and in this form finally dumped into the ashpit below. The Hunt conveyor takes the ash and carries it back to a dumping place some distance in the rear of the boiler, dumping it there automatically.

The boiler feed-water is fully as important as the coal supply. The water of New York city being especially well adapted for boiler use, no filters or purifiers were considered necessary. The pump supplying feed-water to the boilers is one of the H. R. Worthington company's make. It will be electrically driven by one of the Crocker-Wheeler company's pump motors. The pump is one of the "steeple pattern," and, combined with its motor, presents a novel and elegant appearance. Two of the Root feed-water regulating devices, manufactured by the Abendroth & Root Manufacturing company of New York, will work in connection with the boilers and the feed pump, starting the pump automatically when the water level in the boiler falls below its proper level, and again stopping the pump when the water in the boiler tends to rise above its normal working level. Thus the entire working of the boiler is made automatic with the exception of the damper regulation, and here the Locke Damper Regulator company of Salem, Mass., comes to the rescue with one of its damper regulators, and this completes the entire automatic equipment.

So safe and so simple is the entire operation of this plant that it has been decided to put it in charge of a woman to show conclusively that if the steam user will equip his plant in an up-to-date manner throughout, it will become so simple in its operation that a woman can operate it as well as the most expert fireman.

The visitor to this exposition will find many other very attractive and useful features which will well repay his careful investigation. The valves used in the main steam piping, for instance, are especially adapted to high pressure and ordinary rough handling. They are, as will be seen, heavy, straight-way valves with an outside yoke and screw and are made by the Chapman Valve Manufacturing company of Indian Orchard, Mass.

The pressure carried by the boilers will be 125 pounds. This pressure will be carried through the main steam piping to a point just beyond the first engine and there it will be reduced by a Foster reducing valve to 90 pounds, at which pressure it will be carried to all the other engines on exhibition. It will be interesting to follow the steadiness of the working of this reducing valve. This may be done by going to the exhibit of the Ashcroft Manufacturing company, near by, where two Edson recording gauges will be found in operation, one recording the pressure of steam at the boiler and the other gauge recording the pressure on the low-pressure side of the reducing valve. The Foster Engineering company will also exhibit its new automatic safety stop valve, to be placed in the main steam pipe near the boiler. This valve will instantly and automatically close in case of a rupture in the steam pipe or the breaking of any of its fittings. By this means the steam in the boiler will instantly be stopped from rushing into the piping, and accidents due to ruptured steam pipes will be avoided. Another valuable feature used in connection with this automatic stop valve is found in a pipe leading from it containing a quick-closing lever gate valve. When this is opened quickly, the main valve closes instantly, and thus the whole steam supply can be cut off from the main steam pipe at an instant's notice.

The boilers are equipped with steam gauges manufactured by the Ashcroft Manufacturing company and with nickel-seated pop safety valves made by the Consolidated Valve company, both of New York and Bridgeport, Conn.

The visitor cannot fail to be struck with the beautiful finish of the boilers, which have been designed to include utility, durability and elegance in outline. The fine smooth black finish, contrasting so strikingly with the polished nickel work, is produced by the use of Dixon's graphite boiler front paint, made by the Joseph Dixon Crucible company of Jersey City, N. J., whose exhibit will be found in the neighborhood of the boilers. The masonry is also of exceptionally fine appearance and is most creditable to the mason, Garret S. Wright of New York.

The exhaust piping from the eleven engines will probably interest many of the visitors to the exposition, as this type is in use by so many electric light companies for this purpose. It is the spiral riveted pipe made by the Abendroth & Root Manufacturing company of New York.

The battery of improved Root boilers used at this exposition is in exact duplicate to the twelve batteries of boilers used at the celebrated tunnel plant of the Baltimore & Ohio railroad in Baltimore, Md. A fine photograph of exceptional size, showing this plant, will be seen on the wall near the boilers.

The engines on exhibition will all be direct-connected with generators, with two belt-connected exceptions. The engines will be found arranged in the following order, beginning with the engine nearest to the boilers: The Phœnix engine (only compound engine), Ball & Wood engine, Straight Line engine, Harrisburg engine, Watertown engine, Payne engine, McEwen engine, Weston engine (belted), New York Safety engine (belted), Case engine, Shepard engine, Woodbury engine. The exhaust from all of these engines will be passed through a Goubert feed-water heater and then sent through the spiral riveted exhaust pipe (placed outside of the building) to a point above the roof.

All the feed-water used will pass through this heater, thus supplying the boilers with a bountiful supply of water heated to near 212 degrees. Two concerns share the steam pipe-covering work, one putting on Keasbey's magnesia sectional covering, while the other applies Gilmour's asbestos covering.

## Electrical Machinery in Collieries.

Electrical machinery is being rapidly introduced into coal mines. One of the most recently installed plants is that put in by the Scranton Electrical Construction company at the Mt. Pleasant colliery, owned by W. F. Smith of Scranton. The electrical portion of the plant will consist of one four-pole, 100 kilowatt, 650 revolution, 250 volt generator and one electric locomotive from the works of the General Electric company. This colliery is one of the oldest in the vicinity of Scranton and the gangways over which the locomotive will run pass under the center of the city. The locomotive will be required to haul an average of about 400 cars daily from the counter chutes located along the main gangway. The average length of haul one way is about 3,000 feet. In addition to the haulage plant the coal company will operate from the same circuit several rotary coal drills in the same vein. Electricity was selected after competition with manufacturers of steam locomotives to operate in the same mine, and, the gangway being driven in four parallel headings, it would not have been difficult to connect them to give a separate air split for the steam locomotive. The cost of installing a steam locomotive would have been considerably less than the cost of the electric plant. Notwithstanding this, electricity was selected on account of its undoubted advantages and economies in operation over any other system that could be presented.

Another interesting electrical plant is being installed by the Lehigh Valley Coal company, which operates a large number of collieries in the anthracite district as well as many semi-bituminous mines in the Clearfield region. The plant consists of one General Electric 150 kilowatt 550 volt generator furnishing current to one duplex double-acting Jeansville mine pump and one 100 horse power Lidgerwood friction cone clutch single drum hoist. Both of these machines will be set about 6,000 feet from the generator in the center of a long slope in the main coal seam. The circuit to the hoist and pump will be carried about 5,300 feet above ground on a pole line and will then pass down a vertical bore hole 350 feet deep. This part of the line will consist of an iron armored cable and will be suspended solely by the iron armor. The pump will have a capacity of 600 gallons per minute and will lift water through a vertical bore hole to a height of 350 feet. The average work of the hoist will be the hauling of about 15 tons up an eight degree slope at an average speed of 500 feet. The hoist will also be required to lower about five tons down the same slope. The advantages of electric power are strikingly illustrated in this plant. If electricity had not been selected to convey power for the hoist and pump work, it would have been necessary to carry the steam some distance through the mine and provide special bore holes and condensers for the disposition of the exhaust steam.

# CORRESPONDENCE.

## Milwaukee, Wis.

MILWAUKEE, May 1.—The electric lights furnished to the city by the Milwaukee Railway company have been tested by Charles G. Armstrong of Chicago and found not wanting. First the current on each of the 28 arc dynamos was measured, to see whether it came up to the contract requirement, which is 10 amperes. One or two of the machines were one per cent. below this rating, but the general average was 10.14. The engineer also measured the current and the voltage at 12 different lamps in the city. The officers of the company were in no case aware of what lamps were to be tested. The test at each lamp showed that the contract was being lived up to. There is a provision in the contract between the company and the city by which the city is bound to notify the company whenever a test is to be made, and Mr. Armstrong, thinking that it might be assumed that the company had especially prepared its apparatus for the test already described, called at the lighting plant some time afterward, without giving the company any warning of his intention, and again tested the machines, finding that the current was fully equal to the requirements of the contract and that the company had added some apparatus to enable the operators of the plant to test the machines from time to time and ascertain whether the current was sufficient. He also found that the machines which had been low in the former test were higher, showing that the condition in the first test was accidental. The lamps were burning in a satisfactory manner. Mr. Armstrong stated in his report to the council that he had observed nothing which indicated that the lighting company was trying to shirk any of the responsibilities placed upon it by law. He suggested, however, that the city have tests made, at frequent intervals, of the current carried on the machines, as the current is the factor that the company, if it be so disposed, can most easily manipulate. Mr. Armstrong, in an interview, stated that the clause of the contract which required the city to give the company due notice of a test was a mistake, although the same provision is found in many public electric lighting contracts. All the companies need to stand a test, he said, was a little time. Take the Milwaukee plant as an instance. In 20 minutes the operation of the plant can be so changed as to reduce the consumption of coal 30 per cent. He stated that when he inspected the plant it was apparent that everything was being run at high tension. He was positive, however, that the city's 1,400 arc lights, supposed to be of 2,000 candle power each, were being supplied with the necessary amount of electrical energy. C

# PERSONAL.

Prof. M. I. Pupin of Columbia University, New York, has many friends in the West who will sincerely sympathize with him in the bereavement occasioned by the death of his wife. Mrs. Pupin died on April 25th.

Graham C. Woodward of Washington, D. C., is now visiting his brother, Western Manager C. W. Woodward of the Electric Storage Battery company. Mr. Woodward may remain at his brother's home in Chicago and take a course at Chicago University.

Frank C. Cosby, formerly of the engineering staff of the Westinghouse Electric & Manufacturing company at Pittsburg, has taken the place left vacant in the Chicago office of the Standard Underground Cable company by F. S. Vielè's transferrence to Pittsburg, and comes to Chicago as superintendent of construction. Mr. Cosby graduated from Cornell University as an electrical engineer in 1893, and has since been actively employed in electrical work. During the World's Fair he was electrician for the United States naval exhibit on the model battleship Illinois. He will prove an able assistant to Manager J. R. Wiley in taking care of the business of the Standard Underground Cable company in this territory.

# ELECTRIC LIGHTING.

The village of Tully, of 600 inhabitants, situated 20 miles south of Syracuse, N. Y., is putting in an electric light plant operated by water power. The capacity of the plant is 1,000 lights. The town is to be lighted by 18 arc lights, and it is expected that the remainder of the power will be availed of in lighting the stores and

residences. The plant is to be in operation by May 1st. This plant is unique from the fact that it can be made to pay in such a small place, and illustrates well the fact that even the smallest towns realize the advantages of and appreciate the superiority of electric over other forms of lighting.

## TRADE NEWS.

The Ball Engine company, Erie, Pa., has removed its Chicago office to the Monadnock building, room 1526.

S. F. B Morse has closed the contract for Kerite wire for the Great Northern Hotel addition and new theater. This building is one of Chicago's latest and most modern, and the choice of Kerite insulation under much competition speaks volumes for the wire, to say nothing of the persuasive powers of Kerite's western manager.

Stanley Green of the Fuel Economizer company of Matteawan, N. Y, reports sales of Green's fuel economizers for steam boilers during April as follows: Armour Packing company, Kansas City, 2,500 horse power; Detroit Railway company, 2,500 horse power; Goebel Brewery, Detroit, 300 horse power; Englewood & Chicago Electric Railway company, 500 horse power; Lake Cities Electric Railway company, Michigan City, Ind., 500 horse power.

William Arnot, Philip Martin, Michael Duffy and John McKenna, well known underground cable experts, have resigned from the Standard Underground Cable company and have entered the service of the National Underground Cable company. Each of these men has had a long experience in underground and aerial cable construction work of all kinds. Together they are a valuable addition to the National company's already large force. The National company's construction department is now one of the largest in the country, and is in a position to handle any work, no matter how large, with dispatch.

The satisfactory results which may be attained by earnest and systematic efforts to improve the quality of manufactured articles are strikingly illustrated by the character of the cables furnished by the Standard Underground Cable company at the present time for telephone use. A recent large order for the American Telephone & Telegraph company of Providence was sold with a guarantee of 500 megohms per mile insulation resistance and a capacity of .08 microfarads per mile. The tests of these cables by the electrician of the Providence company disclose the remarkably low average capacity of .0743 and .0749 microfarads per mile. The highest capacity of any wire in the cable was .0776 and the lowest .0716, showing a high degree of uniformity. The insulation resistance of the wires averaged 1,933 megohms and 3,300 megohms per mile respectively.

The People's Electric company of Madison, Wis., reports a very active spring opening in the supply business. Orders have already been received from all parts of the territory which it covers. Special activity is noted in the telephone business, and many new exchanges and toll lines are under way or about to be constructed. This company has lately closed some very valuable agencies for electrical specialties, among the number being the Peerless armature compound, Emerson alternating current motors and Badger LeClanche batteries, each of which is a high-grade article. It is the aim and purpose of the company to handle only high-grade goods, and any article that it decides to place upon the market must stand a thorough examination and test in the laboratory as well as the severe criticism of the central station manager. A map prepared to show the territory covered by this company shows that Madison is exceptionally well located to serve as a distributing point for electrical supplies for a large section of the Northwest.

The Ferracute Machine company of Bridgeton, N. J., manufacturer of presses and dies and other sheet-metal tools, makes a number of presses which are especially adapted for the electrical trade. Among others it builds a number of open front presses for cutting armature disks up to 20 inches diameter; also a large number of round and square bed double-crank presses, the bed being placed between two columns. This seems to be the best form of press for cutting large circles for armature disks; also for sections of large disks; the General Electric company has seven of them in use, while many others are using them for electrical work. The Ferracute company also makes an improved indexing machine for notching armature disks of various sizes from three inches to 36 inches diameter. This is arranged with adjustable sliding head and with changeable index-plates so that various numbers of teeth can be made in any size of disk. It also makes a number of sizes of punching presses for cutting out instrument work and other goods in heavy metals, which have proved popular in the electrical trade It expects to exhibit several presses at the exposition and will probably have them running with electric motors and will manufacture a small article. The company issues a handsome catalogue describing some 300 different presses, and also several special circulars for certain trade requirements

The question of selecting a carbon which can be relied upon to do the work for electric lighting has been long recognized as of the first importance by central station men The call for such a carbon caused Dr Albert Lessing of Nürnberg, Germany, to give up a large share of his valuable time in experimenting and gathering data that he might offer a superior article in this line of goods to the electrical trade The demand for the Lessing carbon soon exceeded the supply, but arrangements were recently completed for enlarging the manufacturing facilities, and now orders can be filled promptly. Large orders were taken in London, and it has been said that London is lighted with the Lessing carbon. Arrangements have been perfected with W. L. Strauss & Co., of 27 Warren street, New York, to act as general agents in the United States, and although this agency was only established the first of the year, the orders taken have been so large that Mr. Strauss went to Nürnberg in April to arrange for larger shipments of carbons. Mr. Strauss will remain abroad until some time in June, when he will return and complete arrangements for extensive sales through agents in the leading cities of the country, that the Lessing carbon can be quickly placed in the hands of the purchaser. The Lessing factory at Nürnberg is a large establishment, and is well known throughout Europe as being fitted with the latest apparatus for the manufacture of everything in the line of carbons

## BUSINESS.

The Valentine-Clark company of Chicago, dealer in poles for overhead wiring, has removed from 704 Rookery to 804 and 805 Gaff building, 236 La Salle street.

The Grutting electric soldering iron and curling iron heaters are rapidly becoming recognized as standard goods. The Electric Appliance company of Chicago, as general western agent, is carrying a stock of these goods which is meeting with ready sale.

The Warren P. Freeman company of 106 and 108 Liberty street, New York, announces that it has recently equipped its establishment for the manufacture of fans and motors, and that parts can be had at quick notice, or any apparatus manufactured entire. Automatic machinery and experimental work will be undertaken.

W. W. McChesney, Jr., representing Huebel & Manger of Brooklyn, N. Y., has just returned from an extended western trip in the interests of his company. During the two months that was spent on the trip through the western states Mr. McChesney met with phenomenal success, securing many large orders for his company. In other ways the trip was a very enjoyable one to Mr. McChesney.

The approach of the fan motor season is the incentive for increased activity in this department of the supply trade. The Central Electric company of Chicago has for years secured a very large proportion of this business in the West, and the season of 1896 promises to be no exception. This company has the Lundell fan motor outfits for direct and alternating current circuits, Edison battery motors and Porter battery motors, and can supply any sort of a desk, ceiling or exhaust fan desired. A special fan motor catalogue can be had on application.

The Standard Underground Cable company is determined to place itself in a position where it can handle a contract for any character of installation with the least possible delay. For years it has been able to successfully undertake any contract for installing underground cables of high character, except conduits and rubber-covered wires and cables. Appreciating the importance of meeting every possible demand on the part of the electrical public, a large addition to the already extensive factories has been erected, and a complete modern plant for insulating wire and cables of all descriptions with rubber has been installed therein. This branch of the business has met with unexpected approval on the part of customers, and the high character of the product will undoubtedly steadily increase the output. The arrangements for testing the wires are particularly complete, and the care exercised in this department ensures the production of perfect insulation, or the discovery of any faults before the wire leaves the factory. The motto, "Rubber insulation with rubber in it," will appeal forcibly to those who have used many of the so-called "rubber" compounds.

The Electric Selector & Signal company of New York has moved its offices and workshops to 43 Cortlandt street, in the midst of all electrical industries. It has just completed a new police signal system, which is greatly praised by those who have examined it. The company is still making and installing electric light cut outs, telegraph selectors and other signal devices based upon the selector system, controlled by its patents. Of late it has also made improvements in fire alarm apparatus. The company announces that it is prepared in its new quarters to undertake all electrical repair work, and will also aid inventors with good men and fine tools in experimental work

The "Pioneer" lamp, which is manufactured by the Electric Arc Light company of 687 Broadway, New York, has established itself in the confidence of the trade. The result is the placing of immediate orders. The demand has been so great that arrangements have been completed for a further enlargement of the capacity of the works. It is reported that several gentlemen having a combined capital of over $2,000,000 are now backing this concern. They will push the business in every portion of the country, and propose that every one in the electrical business shall know of their "Pioneer" lamp, through the strongest agencies that can be obtained. A handsome suite of offices has been fitted up at 687 and 689 Broadway, and a fine laboratory located at 250 Mercer street, New York. The "Pioneer" lamp will be very much in evidence in and about the convention hall.

The National Underground Cable company of New York, Boston, Philadelphia and Chicago has just organized a new department for the sole manufacture of Reid tubular terminal heads for electric light and street railway feeder cables and telephone and telegraph cables, to be under the immediate supervision of Edwin S. Reid, the inventor. The Reid terminal may be said to have done more than any other single invention to make underground cables successful, and its value is best shown by the fact that more than one hundred thousand of these terminals are in use to-day in the United States and Canada on underground and aerial cables. These terminals will be used exclusively on the large contracts for underground and aerial lead-covered cables now being performed by the National company for street railway companies, electric light, telephone and telegraph companies in Toledo, Chicago, Richmond, Philadelphia, Pittsburg, Baltimore, Boston and San Francisco.

The popularity of the Ball engine for direct connection to dynamos is well shown by the subjoined list of plants in which Ball engines are directly coupled to Western Electric, Westinghouse, Walker, Crocker-Wheeler, Fontaine, General Electric, Card, C. & C., Siemens & Halske, Waddell-Entz, Eddy, Thresher, Elwell-Parker or Jenny dynamos. The figures show the capacity in kilowatts in each case; C. E. Johnson company building, Chicago, 25; city of Galveston, Galveston, Tex., 30; Security building, St. Louis, Mo., 80; Louisville hotel, Louisville, Ky., 50; Young Women's Christian association, Chicago, 40; J. H. Bishop & Co., Wyandotte, Mich., 25; Tradesmen's Bank building, Pittsburg, Pa., 142½; Apollo Iron & Steel Works, Apollo, Pa., 675; Troy Iron & Steel company, Troy, N. Y., 187½; Duquesne club, Pittsburg, Pa., 50; Mohawk building, Cleveland, Ohio, 102; steamer City of Buffalo, 50; National Tube Works, McKeesport, Pa., 100; Congressional Library, Washington, D. C., 325; Industrial Home for the Blind, Chicago, 30; Herald building, Baltimore, Md., 30; Edison Light & Power company, La Crosse, Wis., 200; Kenwood hotel, Chicago, 80; city of Wells, Wells, Minn., 50; Joel Gutman building, Baltimore, Md., 60; Drew, Selby & Co., Portsmouth, Ohio, 80; Mabley building, Detroit, Mich., 415; Elgin City Railway company, Elgin, Ill., 225; Harper hospital, Detroit, Mich., 80; Tremont building, Boston, Mass., 90; Lynchburg Cotton Mills, Lynchburg, Va., 40; C. & C. Electric company, Garwood, N. J., 100; Juvenile Offenders' Home, Geneva, Ill., 35; Pittsburg National Bank of Commerce, Pittsburg, Pa., 30; Lumber Exchange building, Minneapolis, Minn., 200; city of Adrian, Adrian, Minn., 50; Oskaloosa Edison Electric Light company, Oskaloosa, Iowa, 250; Jevne & Co., Chicago, 40; Safe Deposit building, San Francisco, 40; Willoughby, Hill & Co., Chicago, 75; Cumner, Jones & Co., Boston, 75; Bushnell building, Springfield, Ohio, 40; Denison University, Granville, Ohio, 40; J. N. Adam building, Buffalo, N. Y., 65; Shoneman Bros., Philadelphia, Pa., 35; Century building, Cleveland, Ohio, 102½; Paul O. Stensland building, Chicago, 73; Ohio State Reformatory, Mansfield, Ohio, 200.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued April 28, 1896.*

558,924. Multiple Series System of Electrical Distribution. Francis B. Badt, Chicago, Ill. Application filed December 6, 1895.

This invention comprises the combination with the translating devices connected in multiple series between a compensating conductor and main conductors, of an auxiliary generator or source of electricity, a switch for connecting the generator in circuit with one or the other of the sides of the system, and an electro-magnetic device responsive to a change of the predominating load from one side of the system to the other for maintaining the auxiliary generator in circuit with the overloaded side of the system.

558,953. Eccentric Mounting for Electric Vehicle Axles Ernst W. G. C. Hoffmann, Charlottenburg, Germany. Application filed December 27, 1895.

The claim: In an eccentric mounting for vehicles, the combination with the motor frame or casing, of the motor shaft journaled to rotate in boxes provided upon said frame, a pinion mounted upon one end of said armature shaft, a gear wheel meshing with said pinion, a shaft upon which said gear wheel is mounted, a rotatable sleeve within which said shaft is eccentrically journaled, a laterally projecting lug provided upon said sleeve and carrying a socket to facilitate the rotation of said sleeve, and clamps carried upon said frame for clamping the sleeve in any rotated position to which the same may be moved.

558,970. Method of Electrolytic Treatment of Soap-lyes Orazio Lugo and Huson T Jackson, New York, N. Y Application filed October 4, 1895.

The process of eliminating the caustic alkali from impure glycerine and spent soap-lyes or saponification liquors and the decomposition of the glycerine compounds consists in subjecting the liquors to the action of a current of electricity, the anode being composed of zinc and being retained in contact with the liquor under treatment.

558,971 Electric Connection Joseph W Marsh, Pittsburg, Pa. Application filed May 6, 1895.

An electrical connection is shown provided with a moisture and gas excluding covering, having mica compound or similar moldable insulating material molded to form a tight joint between parts of the connection.

558,983. Current Straightening Commutator. Carl Pollak, Frankfort-on-the-Main, Germany. Application filed August 28, 1895.

One of the claims allowed was for the combination of segments, commutator brushes in sections connected alternately, means for moving a section of each brush toward or from another section of the same brush, and means for simultaneously adjusting all the sections of all the brushes in one direction.

558,989. Hanger for Arc Lamps. Lyman A. Scovil, Chicago, Ill. Application filed March 28, 1893.
In the claim is described a sleeve, and a rod adapted to enter the sleeve, a lug or tongue being provided upon one of the parts, while a longitudinal slot with inclined surfaces leading thereto is provided upon the other of the parts.

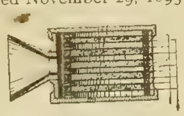
558,993. Safety Arc Lamp Hanger. Edward P. Snowden, St. Joseph, Mo. Application filed February 11, 1896.
The invention comprises a fixedly supported hanger-box, having an open bottom, a switchboard arranged within the hanger box, a pair of spaced vertically disposed switch-plug receivers secured to one side of the switchboard, and provided at a point intermediate of their ends with laterally projecting binding posts extending through the switch-board, a switch-lever connection between the plug receivers, insulator tubes fitted in opposite ends of the box, and having their inner ends disposed directly at one side of the wire-receiving ends of the binding posts, and a vertically movable lamp hanger table carrying a pair of switch plugs, having lamp wire terminal connections therewith, and adapted to work in and out of the switch-plug receivers to operate the switch-lever connection.

559,030. Gasolene Traction Engine. James A. Hockett, Sterling, Kan. Application filed September 6, 1895.
This engine comprises a pair of cylinders arranged tandem, plungers therein, inlet-valve passages communicating therewith, exhaust-valve passages communicating therewith, pins projecting from the plungers, electrical conductors extending through the inlet-valve passages, plates electrically connected thereto, a walking-beam, an electrical battery electrically connected to the base of the engine, a contact plate carried by the walking beam and insulated therefrom, and electrically connected also to the battery and means to operate the plungers and to rock the walking-beam, whereby the circuit will be completed and broken and the exhaust valves opened.

559,038. Automatic Electric Indicator System. Gwynne E. Painter, Baltimore, Md. Application filed February 26, 1895.
The arrangement includes a dial and a pointer, a magneto-mechanical organization for actuating the pointer step by step, an electric switch mechanically actuated by a mechanically driven shaft, electric connections between the switch and the pointer organization, and an electro-magnetic circuit-breaker electrically controlled by the switch, and automatically caused to cut off communication with the electric generator after each step-by-step movement of the pointer.

559,039. Electrical Signaling Apparatus. Gwynne E. Painter, Baltimore, Md. Application filed February 16, 1895.
A shaft is adapted to move a pointer, and is provided with a cam-slot wheel and a magnetically operated lever provided at its free end with a stud or pin which occupies the cam slot in the wheel.

559,048. Electric Running Light and Signal Lantern for Ships. Joseph Barré, New York, N. Y. Application filed November 29, 1893.



NO. 559,106.

The invention covers a running light for ships, provided with a cap at its upper end carrying supports for two or more electric lights, the cap being rotatable with respect to the lamp fixture, whereby the electric lights may be brought successively into focus.

559,066. Mast-arm for Electric Lamps. Joseph J. Shickluna, Buffalo, N. Y. Application filed April 29, 1895.
This mast-arm consists of a pair of converging side members, a head or casing connecting the outer ends of the members, eyes or bearings arranged at the rear ends of the members, and a yoke or bridge connecting the members between the head or casing and the eyes or bearings, and composed of adjustable sections, one of which is provided with a longitudinal slot, and the other with a clamping bolt passing through the slot.

559,086. Telephone and Calling System. Charles B. Smith, New York, N. Y. Application filed November 15, 1895.
In a telephone system having a plurality of stations there are provided a plurality of wires passing through the stations, telephone instruments in the stations, means to connect the instruments with any of the wires, means for sending a call from one station to another and means in each station to give a signal to announce in both stations when the wires between the called and the calling stations have been connected in a closed metallic circuit through the telephone instruments in the calling and the called station.

559,087. Telephone and Calling System. Charles B. Smith, New York, N. Y. Application filed November 19, 1895.
The first claim: In a calling system, a plurality of stations, a plurality of wires passing through said stations, each wire being normally appurtenanced to one station, calling devices and indicators or annunciators in each station, means in one station for giving a call in another station over the wire belonging to the latter station, and means in the first mentioned station for operating an indicator or annunciator over the wire belonging to the calling station.

559,[illegible]. Telephone and Calling System. James G. Smith, New York, N. Y. Application filed February [illegible], 1896.
The invention [illegible] telephone system having a plurality of stations, a plurality of wires passing through the stations, each wire being normally appurtenanced to one station, [illegible] instrument and calling device in each station, [illegible] operating device in each station, [illegible] to be operated from any other station in the system [illegible] to connect the main line wire normally belonging [illegible] station through the telephone instruments [illegible] station.

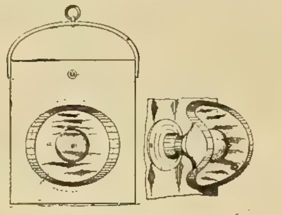
559,[illegible]. Electric Railway Conduit. John H. Munson, Chicago, Ill. Application filed March 5, 1895.
[illegible] the slotted conduit section [illegible] extending part [illegible] to operate [illegible] provided in [illegible] adapted to be operated by [illegible]

559,[illegible]. Telephone Transmitter. Forest A. Ray, Springfield, Ohio. Application filed October [illegible], 1895.
In this device [illegible] diaphragm [illegible] mounted between and supported directly by the diaphragms, a cell containing the comminuted material, a mouthpiece, and air passages communicating with both diaphragms, whereby the resistance varying material is subjected to increased variations of pressure.

559,134. Milliampere-meter. Charles M. Hollopeter, Fostoria, Ohio. Application filed May 31, 1895.
An electrical measuring instrument is described as having, in combination with the upright circular casing of the instrument, an upright tubular socket and an L-shaped bracket arm adapted to have its vertical portion turn in the socket and provided at the extremity of its horizontal portion with a reduced portion swiveled centrally in the back of the casing.

559,143. Electric Light and Signaling Device. David Misell, New York, N. Y. Application filed February 25, 1896.
In a combined lighting and signaling device, the combination of a casing having electrical batteries and a sounding device therein and an electrical lamp thereon and batteries operating the parts, and a spring-actuated handle which is adapted to throw the operative parts into and out of circuit respectively.

559,149. Electric Light Shade. Henry Stenz, Faribault, Minn. Application filed June 27, 1895.



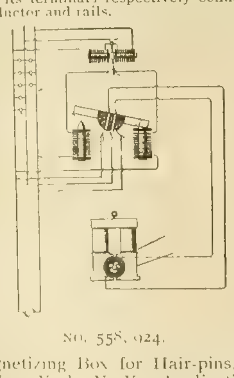
NO. 559,282.

The essential features of this shade are a spring clasp adapted to be engaged with the lamp, in combination with the shade, hinged at one edge directly to the clasp, a friction device carried by the shade, and a friction slide-rod connected to the clasp and engaging the friction device on the shade.

559,155. Process of Hardening Positive Masses of Accumulators. Carl H. Weise, Poessnick, Germany. Application filed July 13, 1895.
This process of hardening the positive plates of storage batteries consists in placing the lead-superoxide plates in a bath of glycerine, and then, while still hot, in a bath of diluted sulphuric acid.

559,168. Connector for Electricity-carrying Cables. David E. Evans, Baltimore, Md. Application filed November 4, 1895.
The claim reads: In a connector for electric cables, the combination of a tubular shell, enlarged centrally and provided with longitudinally disposed slots extending through opposite sides of the enlarged central portion, and set screws at each end of the shell, whereby the cables are held in a fixed position within the shell while their abutting ends are being separated by a suitable tool driven through the slots, and afterward soldered to each other and to the shell.

559,175. Electric Railway. Rudolph M. Hunter, Philadelphia, Pa. Application filed July 8, 1893.
This is a modified overhead trolley system. The poles are located along each side of the roadway and arranged in pairs, one or more series of which are made tubular; the trolley wire is supported from the upper parts of the poles by transverse suspension wires; a conduit is arranged along the roadway, and is embedded therein, having branch openings at intervals communicating with the interior of the tubular poles; a supply conductor is arranged within the conduit and insulated therefrom; branching conductors connect the supply conductor at intervals with the suspended trolley wire, arranged within the branching portions of the conduit and shielded by the tubular posts; removable caps or covers are provided for the branching points of the conduit, with inclosed compartments opening to the street and provided with removable covers for access to the branch points of the conduit; and the source of electrical energy has its terminals respectively connected with the supply conductor and rails.



NO. 558,924.

559,176. Magnetizing Box for Hair-pins. Charles A. Hussey, New York, N. Y. Application filed August 22, 1895.
Ladies will be interested in this important invention. A hair pin box or receptacle is provided with a metallic magnetized form [illegible] supported therein and adapted to support hair pins [illegible] and impart its magnetism to them.

559,187. Electric Governor. Kempster B. Miller, Washington, D. C. Application filed February 25, 1896.
The method of governing the speed of a source of power which consists in generating an alternating current by means of such source of power and causing an increase or decrease in the periodicity of the alternating current to act through tuned circuits to control the speed of the source of power.

559,223. Electric Boiler. Friedrich W. Schindler-Jenny, Kennelbach, Austria-Hungary. Application filed October 2, 1895.
An electric boiler consisting of a ring-shaped heating body of refractory material, containing resistance wires longitudinally extending through the heating body and coming in [illegible] contact with the heating body [illegible] ended.

559,232. Socket for Incandescent Lamps. Julius C. Tournier, Schenectady, N. Y. Application filed March 25, 1896.
In an incandescent lamp socket, an insulating block formed with passages in its edges for the circuit wires, a transverse passageway for the insertion of a controlling circuit key-shaft, its bearings and a controlling spring, a cavity at one end for the location of a rotary metallic tip of the key-shaft, and a cavity at the other end for the location of one of the binding screws and brackets, a cavity at one side of the block for the location of the other binding screw and bracket, and a contact arm.

559,240. Electrically Controlled Clutch. Franklin A. Weller, Boston, Mass. Application filed April 20, 1892.
The first claim reads as follows: In a clutch operating mechanism, the combination with the clutch, the continuously moving driving mechanism, mechanism for moving the clutch into or out of operation actuated by the driving mechanism, and electro-magnets for throwing the clutch-actuating mechanism into engagement with the driving mechanism.

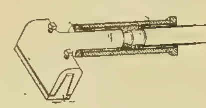
559,254. Electric Heel and Toe Protector. Jennie A. Blair, New York, N. Y. Application filed February 27, 1896.
This device consists of a heel socket and a toe socket connected by elastic bands adapted to extend over the arch of the foot and pockets located in the sockets and separately containing electro positive and electro-negative elements connected by a conductor.

559,256. Plowing by Electricity. Friedrich Brutschke, Charlottenburg, Germany. Application filed January 2, 1895. Patented in Germany February 10, 1894, and in Austria October 5, 1894.
A plow having an electric motor mounted thereon, in combination with a chain stretched across a field, movable cables to convey the current to the electric motor, and one or more free cable-carrying carriages to support the cable as it moves.

559,271. Canal Boat Propulsion. William Elmer, Jr., Trenton, N. J. Application filed December 16, 1895.
In this invention a truck is moved along a track beside the canal by an electric motor. The truck carries a vertical shaft having a sheave, and mechanism connecting the motor with this shaft is provided. The traction cable for towing engages with the sheave.

559,274. Art of Telephoning. Derick H. Fitch, Cazenovia, N. Y. Application filed November 29, 1895.
The combination of a line or circuit, electro-magnet cores and coils, multiple connection between the coils and the main line or circuit, the permanent magnet normally polarizing the electro-magnet, and a signaling device adapted to be actuated by the last named magnet.

559,275. Trolley for Electric Cars. James L. Foster, Waterbury, Conn. Application filed September 11, 1895.



NO. 558,971.

The combination with a rigid trolley arm or pole, having its pivotal part provided with a catch device at its rear portion, of a trigger having one of its arms adapted to engage the catch device when the arm or pole is in contact with the conductor and to be automatically disengaged therefrom when the arm or pole leaves the conductor, a spring or springs connected to the opposite arm of the trigger, a spring connected to the pivotal part of the arm or pole at its lower front portion, and means for engaging the trigger with the catch device.

559,280. Circuit Breaker. Morgan J. Griffith, Wilkes-barre, Pa. Application filed August 28, 1895.
In a circuit breaker, the combination, with a pair of separable contact pieces, of an electro-magnet included in circuit with the contact pieces, a plate of insulating material operating to force apart the contact pieces when depressed, a catch normally supporting the plate, an armature operating to release the catch when attracted by the electro magnet, a rod provided with adjustable tappets and connecting the armature with the catch, and means for depressing the plate automatically when released.

559,282. Electric Lamp. Robert Hacking and George Brand, Nottingham, England. Application filed July 20, 1895.
The first claim is given: The combination with a base piece, of a combined protector and reflector axially rotatable upon the base piece and composed of a U-shaped reflector and a correspondingly U-shaped transparent or translucent protector having its axis of curvature arranged substantially at right angles to the axis of curvature of the reflector and secured to and rotating therewith, whereby the reflector and protector can be rotated in either direction to project the broad part of the beam of light at different angles and to different points.

559,340. Combined Switch and Fuse Block. Edwin H. Montgomery, St. Paul, Minn. Application filed October 2, 1893.
The features of this invention are: A multiple fuse block and switch, comprising in combination a rotary block of insulating material, pairs of fuses arranged transversely thereof and of each other, contacts connected to the fuses, and sets of circuit terminals in the path of the contacts, whereby the pairs of fuses may be successively switched into circuit by the rotation of the block.

559,342. Electric Traction Motor. James F. Place, Montclair, N. J. Application filed March 16, 1894.
The combination with a track rail, an electrical supply conductor arranged along the track rail, an electric traction motor on the track rail, a conveyance to be towed by the motor, an electric switch on the conveyance, and a towline for connecting the motor and conveyance, of a cable composed of four insulated conductors connecting the motor and the switch on the conveyance, two of the conductors connecting the switch respectively with the line supply conductor and one terminal of the field magnet coil, and the other two connecting the switch respectively with the other terminal of the field magnet coil and one commutator brush, and a return conductor connecting the other brush with the earth.

559,348. Telephone Switchboard. Henry M. Fisk, Austin, Ill. Application filed May 27, 1895.
This invention comprises the combination in a telephone switchboard of an electro magnet and a drop or shutter in front of it with connecting or extension points in front of the shutter and a thin plug attached to a flexible cord and made to lock into the connectors or extension points.

Western Electrician.

EVERY SATURDAY.

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## Manufacture of Calcium Carbide.

By Orrin E Dunlap.

The Carbide Manufacturing company, whose plant is on the lands of the Niagara Falls Power company at Niagara Falls, has been merged into the Acetylene Light, Heat & Power company of Philadelphia. The directors of this latter company are T. Morris Perot, a capitalist, who is interested in gas securities; Frederick Rumpf a manufacturer; C. C. Adams of the Postal Telegraph company; E. C. Napheys, a member of a well-known lard refining firm; James A. Vincent, an electrical and mechanical engineer; Samuel L. Kent of the Kent Manufacturing company, and W. W. Ingram, capitalist. All of the men mentioned are Philadelphians. The officers of the Acetylene Light, Heat & Power company are: President, C. C. Adams; vice-president, James A. Vincent; treasurer, E. C. Napheys; secretary, Frank N. Lewis. The company has started its carbide plant, and it announces that it finds from the data so far obtainable that it can manufacture carbide for about $23 per short ton, but this figure is likely to be modified by future results. The current to start the furnaces in operation was turned on by Mrs. Vincent, wife of the vice-president of the company, and the results were such as to please the company. The quality of carbide turned out is very fine and strong in gas qualities.

The carbide plant at Niagara Falls is the first to be erected and operated in America outside of the parent plant in Spray, N. C., illustrations of the furnace of which and the electrode are given in connection with this article (Figs. 4 and 5). As originally erected the factory at Niagara Falls was 40 by 90 feet at the foundation. The structure is of brick, the front portion being two stories high. To this building a brick addition 30 by 60 feet has been added to that part, which is one-story high. An excellent view of the factory is presented in Fig. 7. The front or two-story part of the building is devoted to the crushing and grinding plant of 50 tons capacity, which is illustrated in Fig. 2. To the rear of this is the furnace room, a picture of which is shown on this page, containing four bases, and adjoining the furnace room on the lower floor is the transformer room, Fig. 3. Beyond the furnace room is the storeroom, as at present arranged, but the addition is likely to effect some changes. In fact, the president of the company, C. C. Adams, has announced that a continuous furnace would be added to the plant, as the present furnaces are not continuous. This, of course, should be a material factor in lessening the cost of the production of carbide, about which there is so much dispute at present. The Spray, N. C., factory is located on a narrow-gauge railroad and excessive freight rates are charged upon the ingredients which enter into the manufacture of carbide. And yet it is asserted by a member of the company that despite these drawbacks and in the primitive furnace at Spray, carbide was manufactured at $21.72 per ton. Accepting this as true, few will be disposed to dispute the fact that with the great resources offered at Niagara Falls the cost of the production of carbide can be and will be materially lessened. Niagara Falls, the point selected for production, is within easy access of the Pennsylvania coke supply and the Canadian lime supply, for an analysis of certain Canadian lime proves it to be of superior merit for calcium carbide purposes.

Coke and lime have been referred to as the simple and cheap ingredients from which calcium carbide is made. When finely divided and intimately mixed they are smelted together in an electric furnace. Any form of carbon can be used, but coke gives the best results; any form of lime, either burnt lime, limestone or slacked lime is available, but quicklime gives best results. The coke is ground to an impalpable powder, with crushers and rollers, then sieved through a 50-mesh sieve. The lime is crushed and ground the same way, but not sifted. The coke and lime are then weighed out in proper proportions and mixed in a mechanical mixer From the mixing machine the material is carried to the electric furnace. A supply for as long a time as the design of the building will permit can be stored. No deterioration takes place after the mixing of the materials.

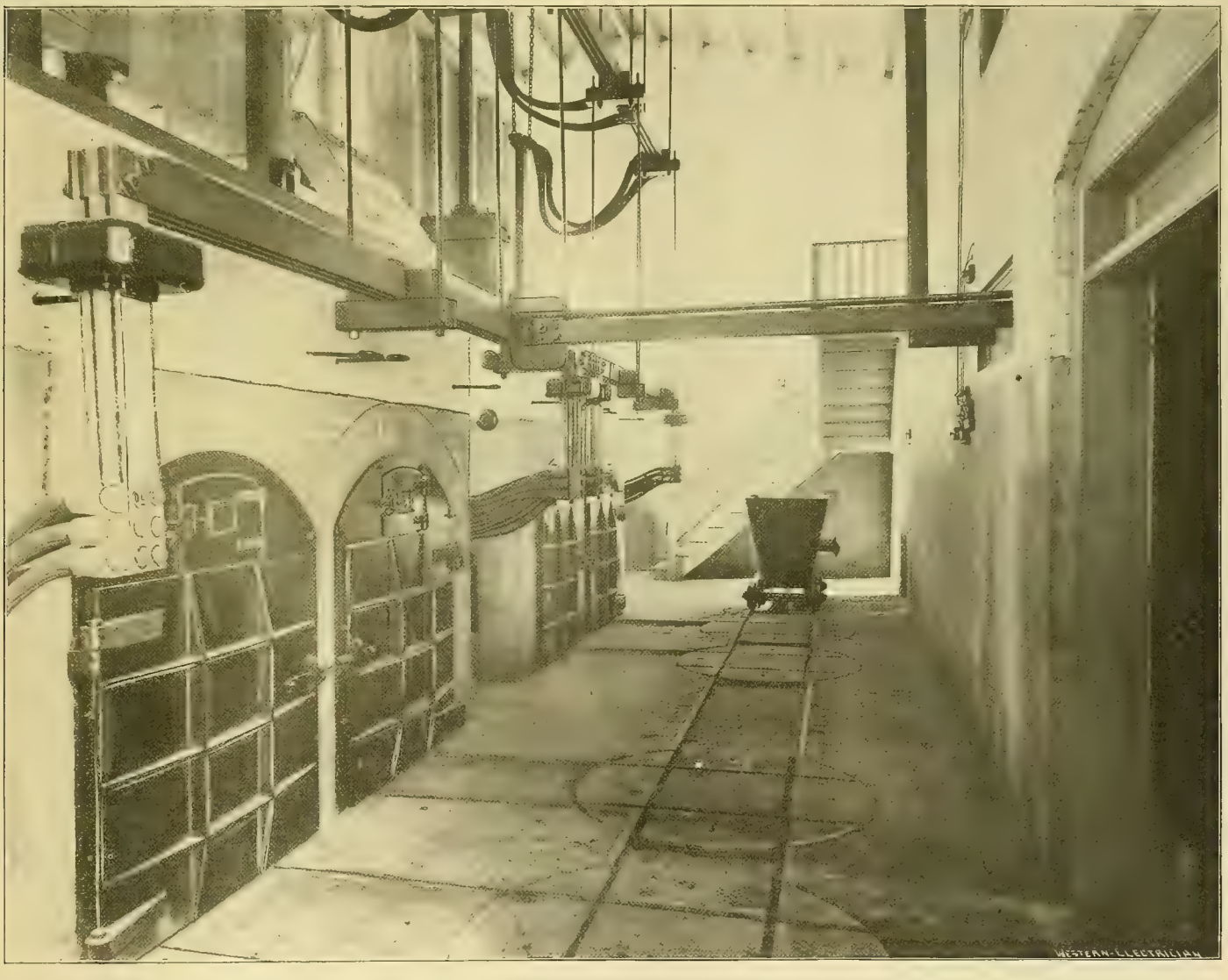



FIG. 1. MANUFACTURE OF CALCIUM CARBIDE.—FURNACE ROOM

The lime air-slacks to a very limited extent. This, however, makes very little difference.

Each of the four furnaces at Niagara contain a cast-iron crucible three feet six inches long, two feet eight inches deep, and two feet two inches wide. The electric furnace consists of a horizontal bed-plate, or crucible, connected to one pole of the generator or transformer, and of a vertical carbon pencil connected to the other pole, suspended above the center of the bed-plate and capable of moving in a vertical direction. The process is started by attaching the carbon pencil to the bed-plate, the passage of electric current taking place instantly. The carbon pencil is then raised, imposing an air gap in the circuit, thus forming the arc. Having established the arc in this manner, the material is fed in toward the crucible or bed-plate covering the arc and surrounding the pencil to a depth of two to three feet. The production of carbide begins immediately. The carbide thus produced forms under the pencil and tends to close the air gap. As the air gap is shortened the resistance of the furnace is lowered and the load increases, which is shown by the ammeter. The attendant in charge then raises the pencil so as to lengthen the air gap, increasing the resistance and lowering the load to its normal amount. This adjustment is necessary every few minutes One man of ordinary intelligence can attend four furnaces. In the installation an ammeter for each furnace is placed in immediate proximity to the carbon-raising device, which controls the carbon for that furnace. After the process has been going on in this manner for from one to three hours, a column of carbide from one to four feet in diameter is formed between the bed-plate and the bottom of the carbon pencil, the arc being maintained between the top of the column of carbide and the bottom of the pencil. As the carbide formed has a substance of more or less high electrical resistance, and as this remains in circuit after it is formed, it is economical to stop the process, clear out the crucible and make a new start after a column of two to six feet, according to the capacity of the furnace, has been produced. The process of drawing a charge consumes from three to five minutes. The carbide is then allowed to cool, after which it is broken up and may be stored for any length of time. It will give up its gas upon the simple addition of ordinary water. This gas, it is claimed, can be kept in a holder and used direct through ordinary pipe and burners, a flow of .8 cubic foot per hour giving a light of 40 candle power against the ordinary tip burning five cubic feet an hour, giving a candle power of 16. An amount of gas equivalent to 4,000 cubic feet of ordinary city gas can be stored in a cylinder whose external dimensions are six inches in diameter by five feet long by compressing it to the liquefaction point. A single reducing valve suffices to lower the pressure as is needed of the liquefied gas to a pressure of 1½ ounces to the square inch, or two inches water pressure, which is the pressure used with ordinary city gas. No compressors are necessary in liquefying the gas.

Each of the furnaces at Niagara is designed to consume 500 horse power. The bed plate in the furnace consists of a cast-iron crucible placed on a car which is run into the furnace on a track under the carbon pencil. A clamping device makes the neccessary electrical contact on the side of the crucible. The pencils consist of six carbon slates 46 inches long, four inches thick, eight inches wide at the lower end and 16 wide at the upper. These are clamped in a cast-iron holder, which in turn is secured to the end of a copper rod 3½ by 3½ inches Flexible copper cables are fastened into the upper end of this rod to permit of a vertical movement of about 12 feet. The carbon pencils, the carbon holder, and the rod are all counterpoise to lessen the work and facilitate the raising and lowering of the upper electrode. After the arc is started the mixed material is fed into the crucible by opening the chute and allowing it to drop in from a bin located above the furnaces.

The present furnaces are of simple construction. They consist merely of retaining walls of ordinary red brick to prevent the material from flying about and being blown mechanically out of the crucible. Carbide has been and can be made on an open hearth without any side walls whatever. While the degree of heat in an electric furnace is simply infernal, it is confined to such a small area that the use of fire brick is not necessary. The furnaces at Niagara, for the present, are wired in parallel and two will be in operation at the same time. Some dioxide of carbon is produced during the process and this carries out of the furnace, mechanically, a small portion of the lime and coke. To provide a settling chamber in which this can be recovered a flue 12 feet long, with hanging walls and diaphragm, is built back of the furnaces and along the floor to a vent at some convenient point. Each furnace consuming 500 horse power, it is asserted, will produce in one day about 2½ tons of carbide

FIG 2 MANUFACTURE OF CALCIUM CARBIDE.—CRUSHING AND GRINDING PLANT.

The electrical equipment of the plant at Niagara consists of one 1,000 horse power single-phase transformer and a reactive coil to be used in starting the furnaces, to prevent an overload on the generators. There is also a 75 horse power two-phase 2,000 volt motor, making 375 revolutions per minute. The transformer is placed as near the center line of the furnace as is possible, to avoid the installation of more heavy trucks than are actually necessary. The 75 horse power motor is used for operating the crushing, grinding and mixing machines, elevators and conveyances. The electrical equipment was furnished by the General Electric company. The crushing and grinding machinery, bins, elevators, conveyors and stalls by Heyl & Patterson of Pittsburg, Pa.

In contemplation of the enlargement of the plant now under way, the crushing and grinding plant installed has a capacity sufficient to turn out material enough to keep furnaces of 50 tons capacity in operation It is stated that Reynoldsville, Pa., coke and Canada lime have been found most suitable for this purpose, the latter containing but little foreign matter.

During the building of the Niagara factory J. M. Morehead was the superintendent of erection. Major Morehead is the electrical engineer of the Electro-gas company of New York and he has given considerable careful attention to the electrical equipment of the plant. To him the writer is indebted for information here given. T. L. Willson has also given this plant considerable attention and has been consulted frequently during the course of construction and equipment. According to statements of the gentlemen interested in this project, the capitalization of acetylene at present organized in the United States will exceed $40,000,000, and the erection of a number of plants is being projected throughout the United States, similar to those now being erected at Lockport (Fig. 6) and Niagara Falls, and the plant now being equipped at St. Catharines, Ont.

## The Commercial Value of Acetylene Gas As an Illuminant.[1]

By Louis A. Ferguson.

It is my intention in presenting this paper to treat of acetylene in its commercial aspect as related to the illuminating industry, and to attempt no description of its value in the chemical world, as the latter is a field entirely apart from that invaded by this association and one so comprehensive that it might well be made the subject of another discourse.

The first step in the process of manufacture of acetylene gas is the production of calcium carbide, which is accomplished by the reduction of lime by carbon with the intense heat of the arc in an electric furnace. The chemical equation representing the action is: CAO+3C=CAC2+CO, the CAO representing the lime, 3C the carbon, CAC2 being the symbol of calcium carbide, and CO carbonic monoxide. Although several experimenters produced carbide of calcium and carbide of sodium and from these acetylene gas many years ago, the first production of carbide of calcium on anything like a commercial scale was made by T. L. Willson at Spray, N. C., while endeavoring to produce the metal calcium in the electric furnace. It was my good fortune to have visited with Mr. Willson his plant at Spray and there carried on experiments in the manufacture of the carbide of calcium and the production therefrom of acetylene gas, and perhaps a few words in description of the apparatus employed may be of interest to you.

Spray is a beautiful little spot about 25 miles southwest from Danville, Va., and about two miles from Leaksville, N. C. It is reached from Danville by a narrow-gauge road, operated by the negroes, the locomotive boiler being fired by wood in true primitive fashion, the roadbed hardly being the equal of the trunk lines between New York and the West. The carbide plant is located alongside of a small stream which has quite a fall at this point, the power of the fall driving a Leffel water wheel, to which are belted two General Electric company's 120 kilowatt alternating current dynamos built for 60 cycles per second. In Mr. Willson's original work he used a direct current dynamo of his own construction, but this was abandoned later and the larger alternating current machines purchased, so as to enable the experiments to be carried on upon a larger scale. It was also imagined that an alternating current dynamo would give better results, it being claimed that the alternating current would keep the mixture of coke and lime stirred up about the arc. This, of course, was a fallacy, the real value in the use of the alternating current machines as compared with the original ones built by Mr. Willson arising from the fact that no commutator being required it was much easier to regulate under the varying conditions of the arc and there was an entire absence of sparking, which was a destructive feature of the original dynamo. The alternators are built for 1,000 volts, arranged to run in parallel, and transformers are used to bring the pressure to 100 volts. The switchboard for the dynamos is provided with ammeters and voltmeters for each dynamo, so that the output may be accurately determined. On the switchboard large cables, capable of carrying 1,000 amperes, run to each of two furnaces, which are built of brick, the dimensions of the furnace being approximately three feet square and eight feet high. Each furnace is provided with a flue to carry off the gases of reduction. In the floor of each furnace is a carbon plate to which the cables connect, this plate constituting one pole of the arc. The upper carbon for the arc consists of six carbons in one cast-iron holder, each carbon being four inches square in cross section and 40 inches long and weighing each 55 pounds. The carbons are raised and lowered by means of a chain winding on a drum operated by a wheel in the dynamo room, so that the energy expended in the production of the arc is maintained constant during the process of manufacture of the calcium carbide. Having thus seen the method of producing the electricity and its application to the electric furnace, we will now pass to the process of manufacture of the carbide. The carbon used in the process at Spray is Pocohontas coke, having a nine per cent ash. The coke is conveyed to a hurricane mill, where it is ground to a fine powder and then put with the lime into a revolving mixer by which it is thoroughly mixed and prepared for the electric furnace. Theoretically the proportions of

1. Read before the National Electric Light association, New York, May 5, 1896.

lime and carbon necessary for the production of 100 pounds of calcium carbide are 87.5 pounds of lime and 50.1 pounds of carbon. These combine according to the formula before mentioned $CaO + 3C = CaC_2 + CO$. 37.5 pounds of carbon combining directly with the metal calcium, forming calcium carbide, and 18.7 pounds combine with the oxygen of the lime, forming carbon monoxide gas which passes off from the furnace.

Nearly 12 months ago, on May 15, 1895, at Spray, N. C., with the described plant, the writer, together with Geroge O. Knapp of Chicago, T. L. Willson, and Major Morehead of Spray, N. C., carried on a test to show the actual production of calcium carbide per horse power per day and the volume of acetylene obtainable per pound of carbide. The coke and lime were prepared in the manner described, the mixture containing 500

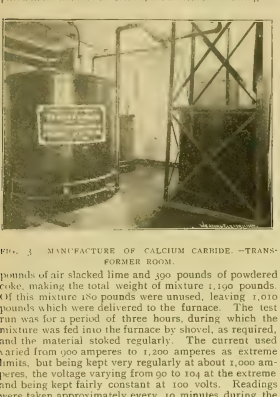


FIG. 4. MANUFACTURE OF CALCIUM CARBIDE.—TRANSFORMER ROOM.

pounds of air slacked lime and 390 pounds of powdered coke, making the total weight of mixture 1,190 pounds. Of this mixture 180 pounds were unused, leaving 1,010 pounds which were delivered to the furnace. The test ran was for a period of three hours, during which the mixture was fed into the furnace by shovel, as required, and the material stoked regularly. The current used varied from 900 amperes to 1,200 amperes as extreme limits, but being kept very regularly at about 1,000 amperes, the voltage varying from 90 to 104 at the extreme and being kept fairly constant at 100 volts. Readings were taken approximately every 10 minutes during the test and from 23 readings the average showed 1,000 amperes and 100 volts, or an average consumption of energy at the terminals of the furnace of 100 kilowatts during the entire run of three hours.

After the current is turned on and the arc made, the carbide begins to form on the bottom of the furnace under the upper carbons, in the shape of a block, and as it forms it is necessary to raise the upper carbons to maintain the proper arc, the current passing from the carbons in the form of the arc to the carbide below, the latter now constituting the other pole of the arc and conducting the current to the plate in the bottom of the furnace. The production of the calcium carbide is by the heat of the electric arc alone and not by electrolysis, the temperature of the arc being in the neighborhood of 3,500 degrees C., while that of the hottest of the ordinary smelting furnaces ranges from 1,200 degrees to 1,500 degrees.

At the end of the run the current was cut off the furnace was allowed to cool down and the product and unused material removed and carefully weighed. During the production of the carbide some of the mixture is lost by passing up the chimney with the gases of reduction, which burn with wild sheets of flame, increasing with their hissing the already deafening roar of the immense alternating current arc. The weight of the calcium carbide actually produced in this test was 139 pounds, the unused material amounting to 607 pounds, to which must be added the water contained in the lime, 165 pounds, making the total unused material 772 pounds. The weight of the mixture delivered to the furnace was, as stated before, 1,010 pounds, so that the actual weight of mixture consumed and lost in the process of manufacture of 139 pounds of calcium carbide was 238 pounds. The efficiency of production, therefore, would be the weight of carbide produced divided by the weight of mixture used up, or 139 divided by 238, which gives 58.4 per cent. as the efficiency of production.

The next step is to calculate from the results of the tests the amount of carbide produced per kilowatt hour. We have seen that the average value of the energy expended in the production of the carbide was 100 kilowatts, and that we produced 139 pounds of carbide in three hours, or at the rate of 46⅓ pounds per hour; therefore the carbide produced per kilowatt hour would be 46⅓ divided by 100, which is $\frac{46}{100}$ pound, or at the rate of 11.12 pounds of carbide per kilowatt per 24 hour day, or 8.3 pounds per horse-power-per day of 24 hours. A sample of this carbide produced, weighing 34.1 grammes, was then taken and the acetylene gas formed by adding water, and the gas evolved measured by means of special apparatus showed a result of 5.24 cubic feet of acetylene gas per pound of carbide after making the proper temperature and barometric corrections.

Having thus seen the quantity of calcium carbide produced for each kilowatt hour of energy consumed, and the value of the carbide as a producer of acetylene, we will now take up the method of production of acetylene from the carbide and consider some of its properties before determining the cost of production of the carbide.

Acetylene is produced from the calcium carbide merely by the application of water, the action being shown by the equation $CaC_2 + 2H_2O = CaO(H_2O) + C_2H_2$. When the carbide is thus brought in contact with the water the acetylene gas is given off rapidly and its presence is distinguished by its very pungent odor, somewhat resembling phosphorous. When lighted it burns with a deep yellow flame and is extremely sooty, but when generated at an even pressure and burned with proper burners, designed for the use of acetylene, it gives a beautiful white light. The acetylene flame so used is exceedingly tenacious and it is almost impossible to blow it out, which may be considered as an advantage in hotels and other places where rural gentleman occasionally take up their abode.

A simple method of generating acetylene from the carbide is to use the apparatus which I will describe. Take an ordinary chloric generator and place within some lumps of the carbide, arrange a glass funnel so that water may be admitted to the interior of the generator, connect the generator by means of a rubber tube to a gasometer, the outer tank being partially filled with water; from the gasometer, above the water line, another tube connects to a gas pipe with a set of burners attached. Water is then poured gradually in small quantities through the funnel into the generator and upon the carbide. The acetylene gas thus generated passes through the tube to the inside of the gasometer and lifts the gasholder, the position of the latter changing with the quantity of gas generated. The gas is then drawn from above the carbide, and as long as it is being drawn the water remains more or less in contact with the carbide, but as soon as the consumption of gas ceases or diminishes, the pressure of the gas forces the water downward into the lower part of the vessel and away from the carbide, thus causing the generation of the gas to cease. An arrangement similar to this is one proposed for country residences.

Acetylene gas may also be used in its liquid form and is prepared by decomposing the calcium carbide with water in a closed vessel and conducting the generated gas under pressure to a condenser, where it liquiefies and is then drawn off in tanks for shipment and distribution.

Compared with other gases acetylene has a very high candle power. Water gas, which is used in nearly all the large cities of the United States for illuminating purposes, when burned at the rate of five cubic feet per hour gives from 20 to 25 candle power, while acetylene when burned at the rate of five cubic feet per hour gives, according to most observers, 240 candle power, or approximately 10 times the illumination of water gas.

The temperature of the acetylene flame is low as compared with that of water and coal gas, Professor Lewes placing the temperature of the acetylene flame at 1,000 degrees C. and the coal gas flame at 1,360 degrees C. It has been stated by Professor Crafts of the Massachusetts Institute of Technology that the true relation of the temperature of the present commercial illuminants when giving the same candle power is: Incandescent light one, acetylene three and water gas nine, showing that the incandescent lamp gives off the least amount of heat per candle power, while acetylene gives three times that of the incandescent lamp and one-third that of water gas.

Many experiments have been made by noted scientists

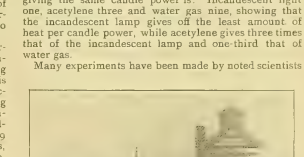


FIG. 7. MANUFACTURE OF CALCIUM CARBIDE.—CARBIDE PLANT AT NIAGARA.

and investigators to determine the poisonous qualities of acetylene gas. Guinea pigs, dogs and other animals have been made martyrs to science and subjected to mixtures containing carbonic oxide, which is the poisonous constituent of ordinary illuminating gas, and after their death their blood has been examined and the amount of carbonic oxide absorbed by the blood determined. Grehant made comparisons of carbonic oxide and acetylene, to determine their relative poisonous qualities, upon dogs. In his experiments he used 20 per cent. of each in his mixtures, so as to prevent the animals' death by suffocation. He added enough Paris illuminating gas, which contains seven per cent. carbonic oxide, so as to give one per cent. carbonic oxide in the mixture. The dog showed signs of suffering after three minutes and in 10 minutes he was very sick, and his blood showed 27 volumes in 100 of carbonic oxide. Another dog was subjected to a mixture containing 20 per cent. oxygen and 20 per cent acetylene and breathed without inconvenience for 35 minutes. Upon examination his blood showed 10 per cent acetylene, less than one fiftieth the rate of absorption of carbonic oxide. The mixture continued much more acetylene than that to which a person could be subjected in the use of acetylene as an illuminant, since a leak of the gas would produce an explosion in the room of a dwelling house before the percentage of acetylene mentioned were attained in the atmosphere. Similar experiments were carried on by Brociner, Berthelot and Claude Bernard, and the conclusion of the best authorities indicate that acetylene when pure is not poisonous. Berthelot has pointed out that the old method of preparation of acetylene by means of acetylide of copper may contaminate the gas with hydrocyanic acid and thus render it poisonous.

Having seen how the calcium carbide and acetylene are made and having considered their properties, the

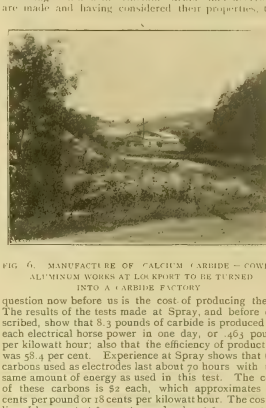


FIG. 6. MANUFACTURE OF CALCIUM CARBIDE.—COWLES ALUMINUM WORKS AT LOCKPORT TO BE TURNED INTO A CARBIDE FACTORY.

question now before us is the cost of producing them. The results of the tests made at Spray, and before described, show that 8.3 pounds of carbide is produced by each electrical horse power in one day, or .463 pound per kilowatt hour; also that the efficiency of production was 58.4 per cent. Experience at Spray shows that the carbons used as electrodes last about 70 hours with the same amount of energy as used in this test. The cost of these carbons is $2 each, which approximates six cents per pound or 18 cents per kilowatt hour. The cost of lime I have put at $5 per ton and coke at $2.50 per ton, these figures being about the average prices for these materials of good quality, and considerably less than the actual cost of them at Spray. The question of the cost of electrical energy is the all important one, so that I have taken the Niagara price of $20 per electrical horse power per year of 8,760 hours, considering this to be the lowest commercial price obtainable at the present time, and one which offers no question as to its accuracy, it being one which is absolutely tangible. The estimate is further based on the assumption that the carbide plant is to be operated at full load 24 hours per day and 365 days each year, so that the actual cost per electrical horse power per year consumed may not exceed $20 divided by 8,760, which is .238 cent, or .317 cent per kilowatt hour. With this data as a basis the cost of producing one ton of calcium carbide at Niagara Falls, in a plant having 10 200-kilowatt furnaces producing 10 tons of carbide per day, would be as follows:

| | |
|---|---|
| Power— | |
| 4,320 k. w. hours at 317 cent per k. w. hour | $13.69 |
| Material: | |
| 2,085 pounds of lime at $5 per ton | 5.21 |
| 1,339 pounds of coke at $2.50 per ton | 1.67 |
| Carbons. | |
| Carbons for 4,320 kilowatt hours at 18 cents per kilowatt hour | 7.78 |
| Supervision and labor operating two shifts of 12 hours each— | |
| 1 superintendent at $5 | $ 5.00 |
| 1 chemist at $4 | 4.00 |
| 2 foremen at $2.50 | 5.00 |
| 10 regulating men at $1 | 10.00 |
| 6 furnace men at $1.50 | 9.00 |
| 2 grinders at $1.50 | 3.00 |
| 6 laborers handling and grinding and mixing at $1.50 | 0.00 |
| | $45.00 |
| Labor, per ton, $45 ÷ 10 | 4.50 |
| Cost of barrels and preparing carbide for shipment | 1.00 |
| | $84.85 |
| Interest at six per cent on $25,000, the investment necessary to erect the factory, furnaces, crushing and mixing machinery, apparatus for handling and regulating | $1,500 |
| Depreciation on $25,000 at five per cent. | 1,250 |
| Taxes at $10 per $1,000 | 250 |
| Insurance at $3 per $1,000 | 75 |
| | $3,075 |
| Cost of production at Niagara | $11.60 |
| Freight from Niagara to New York, Philadelphia, Boston or Chicago at 15 cents per 100 pounds | 3.00 |
| | $17.60 |

This estimate of cost per ton of calcium carbide is intended to represent the cost of manufacture to a large gas company operating in New York, Boston, Philadelphia or Chicago with its calcium carbide works at Niagara, and whose business would be to produce acetylene from the carbide in the city where the gas is to be used, and to distribute it to its customers through its existing mains. It is not intended to represent the cost cleared off its books of any corporation or firm whose sole business would be the manufacture of calcium carbide for the market, for to cover that case we must add to the above estimate the cost of general expense, including administration, royalties and selling expenses, which of necessity would be equal to a large percentage of the factory cost as given. Let us then consider the value of acetylene to the gas companies in large cities: In many articles and circulars treating of this question, it has been customary to place the actual cost of acetylene as produced from the carbide, taking the factory cost of the carbide as a basis, against the selling price of illuminating gas at $1 per thousand cubic feet. This, of course, is not a fair comparison and is very misleading. Believing that the only fair way to consider the relative value of acetylene and water gas is to compare them upon the basis of cost per candle power hour in the holder, and assuming that the cost of distribution is the same in each case, I will treat the question on that basis

We have seen from the results of the tests at Spray that for each pound of carbide we obtained 5.24 cubic feet of acetylene, or 10,500 cubic feet per ton; therefore the cost per thousand cubic feet of acetylene would be one-tenth the cost of one ton of calcium carbide. The candle power of acetylene being placed at 240 for each five cubic feet of gas, and the candle power of water gas in the large cities at 25 for each five cubic feet of gas, it will be seen that the candlepower of acetylene is 10 times that of water gas per thousand cubic feet, and, therefore, the cost of acetylene giving the same candle power as water gas would be equivalent to water gas at a cost per thousand cubic feet equal to $\frac{1}{100}$ of the cost per ton of calcium carbide. For example, if the calcium carbide costs the gas company $100 per ton, then the cost of acetylene gas in the holder will be equivalent to 25 candle power water gas costing $1 per thousand in the holder.

The present average cost of illuminating gas in the holders of the large gas companies approximates 30 cents per thousand cubic feet, while the cost of acetylene gas in the holder with calcium carbide at $37.69 per ton would be equivalent light for light to illuminating gas at $37\frac{7}{10}$ cents per thousand cubic feet, making the cost per candle power hour of pure acetylene approximately 20 per cent. higher than that of ordinary illuminating gas. If acetylene were mixed with air and distributed the cost would be less. This has been done in an experimental way, using 60 per cent. acetylene, and 40 per cent. air, but the advisability of attempting to distribute such a mixture through a system of mains in a city for commercial use is exceedingly questionable, owing to the risk of the mixing being improperly done and the quantity of acetylene falling to such a percentage as to form an explosive mixture

It has been suggested that the cost of distribution, as well as the cost of mains and maintenance, which constitute a large portion of cost in the lighting industry, might be saved by the use of liquid acetylene, put up in cylinders and delivered to the stores, residences and offices, so that the consumer might generate his own gas as required. It appears to the writer that this method is an entirely impracticable and uncommercial one, as there are almost insurmountable objections to be overcome. Neither the average business man nor the occupant of a residence wish to be bothered with the care [illegible] attendant upon the use of the cylinders of acetylene. It would be necessary either to have two [illegible] ready for service or to have a second one [illegible] before the first one was exhausted, and in all probability the busy man would find himself in darkness at the time when he most needed the light, [illegible] the fact that he had neglected to renew his [illegible]. The pressure of the gas in these cylinders is [illegible] pounds, so that it is necessary to use a [illegible] which will give a pressure of one ounce. The [illegible] valve which is used with the Pintsch system [illegible] employed, but this, in all probability, [illegible] kept in condition by the ordinary householder or storekeeper, and the consequence would [illegible] the full pressure might be impressed upon the pipes, and, in case this were prevented by the use of an auxiliary safety valve, then every failure of the reducing valve would allow all the gas to escape and be lost. The use of acetylene cylinders would increase the danger in case of fire, since the gas would escape should the cylinders become heated, and explosions of the mixture of acetylene gas and air would possibly follow. After considering the many inconveniences and dangers in the use of liquid acetylene in the business and residence districts of the large cities, it leads the writer to believe that acetylene to be commercially successful must be delivered to the customers in the form of gas through a system of mains, as is now done with ordinary illuminating gas. Liquid acetylene should find a field in the lighting of country estates, railway trains, and for use in carriage, bicycle and locomotive head lamps, and in isolated places where distribution by mains is not possible.

When acetylene was first brought forward to be used commercially it was expected that the gas companies might still maintain their existing gas works and use acetylene to enrich their gas and furnish a 25 candle power flame, as formerly, but at a much less cost. Experiments have shown, however, that although coal gas may be enriched by acetylene, water gas is not susceptible to enrichment by it. Water gas, which is furnished in nearly all the large cities, has little illuminating power of its own, is now treated with petroleum, and it is only when enriched to a certain candle power that acetylene may be mixed with it without losing its candle power, so that we cannot, as at first supposed, substitute acetylene for petroleum and use it economically as an enricher of low candle power water gas.

It has been suggested that the manufacture of calcium carbide might be carried on by the central station electric lighting companies as a by-product, furnishing the energy necessary for its production during the hours of light load upon the lighting system, thus bringing the load curve of the station nearer to a straight line and thereby improving the economy of the station operation. It will be readily seen from the figures given in the estimate of the cost of producing the carbide, that the cost of power is a very important factor, and if we increase the cost given, of $20 per horse power per year, we will correspondingly increase the cost of the carbide. From experience with the cost of operation of the largest central lighting stations in this country, the writer can safely state that the absolute cost of fuel alone in the most economically operated lighting station of the most modern type of multiple expansion condensing plant averages .3 of one cent per kilowatt hour, or approximately $20 per horse power per year, continuous service, while the total cost of generation in the station would average over double that amount. In the average of the large central stations the generating cost at the switchboards, without distribution and general expenses approximates one cent per kilowatt hour, which is about $65 per horse power per year, and in the smaller stations using steam double that amount. It is obvious, then, that we may not hope to use our present central stations during minimum hours for the manufacture of calcium carbide as a by-product while the cost of power in our stations remains as it is at present, and the amount of power required for the production of carbide so excessive, as the cost of its production by the central station would be prohibitive. It would be much better and more economical for the central station manager to sell his electrical energy through the incandescent or arc lamp at the same price per kilowatt hour than to use the energy for the production of carbide, since the cost per candle power hour would be less when the electrical energy is converted into light directly through the incandescent and arc lamps than through calcium carbide and pure acetylene, assuming the cost of distribution and general expense to be the same in each case. Take for example, carbide at $40 per ton, which means 40 cents cost per 5,000 candle power hours of acetylene gas in the holder, or 125 candle power hours for one cent. Compare with this electrical energy at the switchboard at two cents per kilowatt hour. For each kilowatt hour generated we obtain 20 50-watt incandescent lamps each giving 16 candle power, making a total of 320 candle power hours per kilowatt hour, or 160 candle power hours for one cent., which is 28 per cent. more candle power for the same expenditure of money by the use of the incandescent lamp directly as a converter of electrical energy into light as against the conversion by means of carbide of calcium and acetylene.

If we take the case of the arc lamp and add to the cost of the electrical energy 1.5 cents per kilowatt hour for carbons, trimming and lamp repairs, making the total cost 3.5 cents per kilowatt hour, we find it still more advantageous. Assuming a 500 watt arc lamp gives 1,000 candle power, we have 2,000 candle power hours per kilowatt hour, or 575 candle power hours for one cent, which is 4.6 times the illumination for the same money as compared with pure acetylene gas.

Furnace at Spray, N. C., where carbide was first made.

Electrode of Furnace at Spray.

FIGS. 4 AND 5. MANUFACTURE OF CALCIUM CARBIDE.

Taking the cost per kilowatt hour at the switchboard in the large central stations, we obtain 320 candle power hours for one cent, which is 156 per cent. more candle power for the same expenditure of money by the use of the incandescent lamp directly as a converter of electrical energy into light as against the conversion by means of carbide of calcium and acetylene.

By means of the arc lamp on the basis of cost of one cent per kilowatt hour for electrical energy and 1.5 cents per kilowatt hour for carbons, trimming and lamp repairs, we obtain 800 candle power for one cent, or 6.4 times the illumination for the same money as compared with pure acetylene gas.

From these deductions and considerations, gentlemen, it may be concluded, in the light of our present knowledge and upon the basis of the estimated cost of production of the calcium carbide, acetylene gas should not drive the incandescent and arc lamp from the lighting field, neither should it make such inroads on the electric lighting business as to materially affect the earnings of existing central station companies, for after all, acetylene is a gas and burns with a naked flame, and the use of incandescent and arc lamps has steadily increased year by year, not because of their cheapness, but because of their infinite superiority as illuminants over any gas flame yet developed.

DISCUSSION.

F. NICHOLLS: There is one point about which I would like to ask Mr. Ferguson, and that is, upon the question of transportation in barrels. He has fixed a certain price for barrels, etc., and it has occurred to me that if acetylene had to be shipped in large quantities, it would have to be placed in hermetically sealed packages. From what experience I have had, I do not believe it would be safe to ship it in barrels. I know the slightest moisture seems to affect it, and in much the same manner as lime is affected by moisture. One drop of moisture on acetylene will cause the gas to generate quickly; and if that came in contact with a flame, with a lighted match for instance, I think it might prove disastrous. I have not had any practical experience in the matter, and I would like to ask Mr. Ferguson if he has examined that aspect of the case.

MR. FERGUSON: I do not think anybody has had any experience in the actual shipment of acetylene, but I have no doubt Mr. Nicholls is quite right in his assumption. The estimate I have made is probably very low as to the cost of barrels and the cost of shipment, but as it was such a small item, I thought I would put it on that basis, which would cover the cost of ordinary barrels of sufficient strength to contain the calcium carbide; whereas, in all probability, in actual practice, you would have to use hermetically sealed tins or irons of some kind.

JOHN I. BEGGS: I think the paper presented by Mr. Ferguson is the most comprehensive and exhaustive treatment of the matter, both from a manufacturing and competitive commercial standpoint, that I have seen, and I have tried to read everything published in connection with this matter. It thoroughly confirms my own impressions and calculations. I think that this association should extend to Mr. Ferguson a vote of thanks for the very great care with which his paper has been prepared and presented; and I desire to make that motion in connection with another, that the secretary be directed to have the paper printed in pamphlet form, with the least possible delay, and a number of copies sent to each of the members of this association.

The president put the question, upon the motion of Mr. Beggs, and it was carried unanimously

## The Newly Elected President.

Frederic Nicholls of Toronto, who was elected president of the National Electric Light association at the New York meeting, is one of the best-known central station men in America. An excellent portrait of the newly elected executive was presented in the last issue of the WESTERN ELECTRICIAN. At that time attention was directed to Mr. Nicholls' experience as a central station man and his interest in the lighting plant at Toronto. It might be added that President Nicholls has many other interests in the electrical field. He is vice-president and general manager of the Canadian General Electric company, secretary of the London Electric Light company, president of the Brantford Street Railway company, vice-president of the Peterborough Street Railway company, and director of the Toronto & Scarboro Railway company. Mr. Nicholls has been connected with the lighting industry so long and has followed the proceedings of the National Electric Light association so closely that his selection cannot fail to result in advantage to the organization. During the last convention he had occasion to preside over the deliberations of the association in the temporary absence of President Wilmerding, and the grace and ease with which he acquitted himself indicated that he would make an excellent presiding officer.

The franchise and property of the Victoria Electric Railway & Lighting company of Vancouver, B. C., were sold on April 11th for $340,000.

## Formal Opening of the Electrical Exposition.

The great electrical exposition, held in New York under the auspices of the National Electric Light association and the American Street Railway association, is now in full swing, and if the promise of the opening days is borne out by continued popular interest, the show will prove eminently successful. The display comprises about 150 distinct exhibits, many of great attractiveness to the public, and the general effect, especially at night, is brilliant.

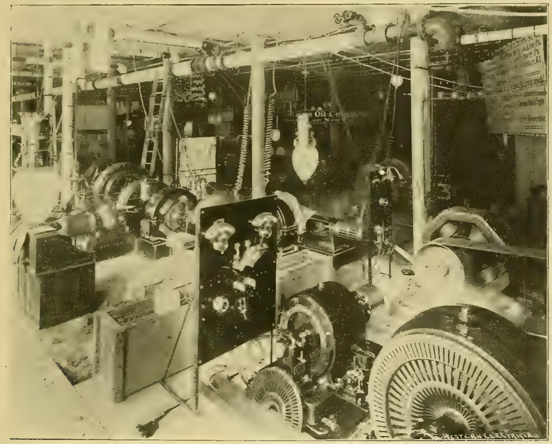
The show was opened according to programme by Governor Morton on the evening of Monday, May 4th. The governor has taken much interest in the exposition. In accepting the invitation to press the key marking the opening of the exhibition, he wrote: "As you are doubtless aware, I am just now under a great pressure of official duties, but the cause of electrical science involves such manifold and important interests in the scheme of our civilization and material progress, that I feel honored and pleased by your request that I shall perform this conspicuous and interesting service. Mankind has witnessed such marvelous discoveries and improvements in electricity, even within the past five years, that our minds are led to wonder whether the world is undergoing a process of revitalization through this subtle energy drawn from the breast of Nature." In making good his promise the governor used the gold key used by President Cleveland at the World's Fair, described in the last issue of the WESTERN ELECTRICIAN. He stood on the first balcony of the Industrial building, where a platform had been arranged. Before pressing the key the governor expressed his sense of the honor conferred and declared the exposition open. As he made the contact the hall, which had hitherto been in semi-darkness, was in a second a scene of dazzling light, while a framework of vacuum tubes which had been built around the spot where the governor stood glowed with a beautiful light blue fluorescence, and the words, "Let There be Light," appeared in luminous letters above the platform. Simultaneously with the pressing of the button guns were fired by means of an electric current in San Francisco, New Orleans, St. Paul, and Augusta, Me.

The preliminary exercises were opened by President Wilmerding of the National Electric Light association, who introduced Mayor Wurster, in the absence of Mayor Strong. Brooklyn's chief magistrate remarked that this is the electrical age. He did not say that "electricity is in its infancy," but ingeniously paraphrased that well-worn expression by asserting that "we have scarcely crossed the threshold of its possibilities." The mayor gave way to Commodore P. Vedder, who delivered a rhetorical address on "The Electric Era." The governor then stepped forward and formally opened the exposition

Governor Morton was accompanied by several members of his staff, and among those who were present with him in the reserved enclosure on the first gallery were Commodore Sicard, representing the secretary of the navy; General Ruger, representing the army; Thomas A. Edison, Nikola Tesla, Professor W. A. Anthony, Mayor Wurster and ex-Mayor Schieren of Brooklyn, Dr. Park Benjamin, Dr. F. B. Crocker, P. B. Delany, Herbert Laws Webb, T. C. Martin, H. H. Vreeland, ex-Mayor Thomas F. Gilroy, Fire Commissioner La Grange, C. H. Wilmerding of Chicago, president of the association; Frederic Nichols, first vice-president, Toronto; E. F. Peck, second vice-president, Brooklyn; George F. Porter, secretary and treasurer, and C. O. Baker, Jr., of New York city.

There was a great throng in attendance, the number of spectators being variously estimated from 5,000 to 10,000. The street outside had been packed for half an hour before the doors were opened, and when they were and the first rush came, the box of one of the ticket sellers was smashed up against the wall, and the official inside thought for a moment that he was in bodily danger. There were several policemen on hand and they had the crowd in hand in a moment. It took about 15 minutes to fill the main hall.

Comparatively few of the exhibits were completely installed on the opening night, but the work was rapidly pushed forward. Manager Stump announced that Chauncey M. Depew would be present at the exposition at an early date to give a message which would be sent from one end of the main balcony around the world, 26,000 miles, and received at the opposite end of the balcony in the Industrial building. Mr. Depew will deliver an address on that occasion on the subject, "Electricity Down to Date," in which he will refer to the future of electricity as a motive power upon the railroads of the country.



GENERAL VIEW OF ELECTRIC POWER PLANT AT THE EXPOSITION

## Network of Electric Railways in New England.

Robert H. Derrah, secretary to President Little of the West End Street Railway company of Boston, has prepared an interesting map showing the extent of street railway work in Massachusetts. Very few people understand that a continuous journey can be made from Gloucester Mass., or Nashua, N. H., on street railway lines, not only to Boston, but through Boston to Brockton, and with the completion of lines proposed through Bridgewater to Taunton, to Fall River and Fairhaven, upon the south shore of Massachusetts bay. The trolley lines already extend southwest to Milford, only a few miles from the eastern terminus of the Worcester street railway, now ending in Grafton, and with this gap filled a continuous trip can be made from Boston to Spencer. Development on account of the electric road has been pretty extensive around Braintree and Brockton upon the south and Woburn, Wakefield and Beverly on the north. The valley of the Connecticut river has also developed a considerable trolley system of its own

## Delegates and Visitors.

Following is the list of attendants at the National Electric Light association convention registered at the secretary's office

| | |
|---|---|
| Ackerman, P. C | New York |
| Aitken, John W | Carbondale, Pa |
| Albright, H. F | Chicago |
| Allen, Charles W | Germantown, Pa. |
| Almstead, J. A | Rochester, N. Y. |
| Anderson, H. S | Springfield, Mass |
| Armstrong, E. A | Camden, N. J. |
| Atkinson, E. P. | New York |
| Babcock, E. L | Cuyahoga Falls, Ohio |
| Baechtold, C | Brooklyn |
| Bain, Forée | Chicago |
| Ballda, W. C. | Utica, N. Y. |
| Balkam, H. G | Washington, D. C. |
| Banton, W. S | Brooklyn, N. Y. |
| Barnes, C. R | Rochester, N. Y. |
| Basken, Jr., C. O | New York |
| Bates, James A. C | New York |
| Bean, W. Worth | St. Joseph, Mich |
| Beggs, John I | Cincinnati, Ohio |
| Belate, James L | Norfolk, Va |
| Bennington, Jr., C. R | Providence, R. I. |
| Biddle, James G | Philadelphia |
| Black, Howard D | Montreal |
| Blaisdell, George A | Woburn, Mass |
| Blakeslee, George G | Naugatuck, Mass |
| Blodd, B. H | Pittsburg |
| Bonney, John P | Brooklyn, N. Y. |
| Bosley, Arthur L | Frederick, Md |
| Bottomley, H | Marlborough, Mass |
| Bournonville, A | Philadelphia |
| Bovey, Henry T | Montreal, Can |
| Bradley, J. M | Birmingham, Ala |
| Brady, T. H | New Britain, Conn. |
| Briggs, H. H | New York |
| Brixey, W. R | New York |
| Brophy, William | Boston |
| Browne, William H | Montreal |
| Browning, Victor | Cleveland, Ohio |
| Bubert, J. F | Boston, Mass |
| Burleigh, C. Carroll | Camden, N. J. |
| Burleigh, J. J | Camden, N. J. |
| Burns, Charles F | Rochester, N. Y. |
| Cabot, J. A | Cincinnati, Ohio |
| Carnes, S. T | Memphis, Tenn. |
| Carty, J. J | New York |
| Chamberlain, W. W | Norfolk, Va. |
| Chambers, N. Willis | New York |
| Chapel, E. A | Chelsea, Mass. |
| Chapin, Charles E | New York |
| Childs, Arthur E | Boston, Mass |
| Coggshall, H. F | Fitchburg, Mass |
| Collins, W. Forman and wife | Chicago |
| Conner, W. A | Pittsburg, Pa |
| Corpening, C. M | Philadelphia |
| Corrin, W. H | Oil City, Pa |
| Corey, R. B | New York |
| Coughlin, W. H | Worcester, Mass. |
| Couilliard, J | Boston, Mass |
| Cowling, J. T | Philadelphia |
| Creaghead, Thomas J | Cincinnati, Ohio |
| Cribben, Henry | Chicago |
| Crider, J. S | Pittsburg, Pa. |
| Crocker, F. B | New York |
| Crossman, T. E | Brooklyn |
| Crouse, J. B | Fostoria, Ohio |
| Cushing, Samuel D | Binghamton, N. Y. |
| Cutler, B. W | Boston |
| Darlington, F. W | Philadelphia |
| Davenport, George W | Boston, Mass. |
| Davis, D. L | Salem, Ohio |
| De Camp, A. J. and wife | Philadelphia |
| Dee, James R | Houghton, Mich. |
| Derby, L. A | Lowell, Mass. |
| Dodsworth, L. A | Charlotte, N. Y. |
| Dow, Alexander | Detroit, Mich. |
| Draper, Paul A | Washington, D. C. |
| Dunn, D. W | Pawtucket, R. I. |
| Edgar, H. F | Atlanta, Ga |
| Ellard, J. W | Baltimore |
| Fairbanks, H. H | Worcester, Mass. |
| Fargo, C. E | Canajoharie, N. Y. |
| Ferguson, James and wife | Brooklyn |
| Ferris, W. J | Chicago |
| Field, A. W | Columbus, Ohio |
| Findlay, J. H | Ogdensburg, N. Y. |
| Fish, Frederick | Rochester, N. Y. |
| Fish, G. E. | Little Rock, Ark. |
| Fisher, J. W | Massillon, Ohio |
| Foote, James B | Jackson, Mich. |
| Forbes, George | Olean, N. Y. |
| Francisco, M. J. and wife | Rutland, Vt. |
| Francisco, J. H | Rutland, Vt. |
| Friend, H. W | Vincennes, Ind. |
| Furbeck, George W | Chicago |
| Gage, J. Arthur | Lowell, Mass |
| Galpin, H. F | Chicago |
| Gans, John L | New York |
| Gardner, W. R | Pittsfield, Mass |
| Gardner, F. F | Newark, N. Y. |
| Garrison, A. C | St. Louis |
| Gilbert, F. A | Boston |
| Girvira, W. H | Syracuse, N. Y. |
| Golsin, H. F | Chicago |
| Gommel, Robert J. M | Pittsburg, Pa. |
| Gray, H. C | Greenwich, N. Y. |
| Gregory, C. E | Chicago |
| Hadley, J. C | Pana, Ill |
| Haldeman, Thomas W | Pottsville, Pa. |
| Hall, George | Ogdensburg, N. Y. |
| Halsy, C. S | Boston |
| Hammer, William J | New York |
| Hansen, L. E | Woburn, Mass |
| Harding, H. McL | Cleveland |
| Harrington, F. W | New York |
| Hart, Gerald W | Hartford, Conn |
| Hawkins, F. M | New York |
| Hayden, M. M. and wife | Cleveland, Ohio |
| Heinrichs, Ernest H | Pittsburg |
| Henderson, F | Charlotte, N. C |
| Hill, Frederick T. G | Waltham, Mass. |
| Hill, W. S | New Bedford, Mass |
| Hillyer, Jr., E. Chauncey | Easton, Pa |
| Hoag, George M | Cleveland, Ohio |
| Holman, George W. G | Philadelphia |
| Holmes, Welles E | Newton, Mass |
| Hoyt, B. St. John | Terre Haute, Ind |
| Hunt, Charles B | London, Ont |
| Issertel, Henry G. | New York |
| Jennings, John J | Wilkinsburg, Pa |
| Johns, Samuel C. D | Cleveland, Ohio |
| Johns, S. K | Cleveland, Ohio |
| Johnston, A. W | Cincinnati, Ohio |
| Johnston, W. J. | New York |
| Jones, A. J | New Brunswick, N. J. |
| Jones, A. H | Philadelphia |
| Karger, Lessing | Houghton, Mich. |
| Keefer, Edwin S | New York |

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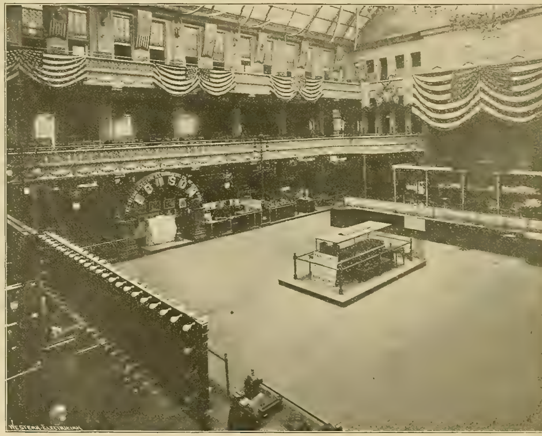
|---|---|
| Kellogg, L. W. | Boston, Mass. |
| Kennedy, James | Washington, D. C. |
| Kittle, E. B. | New York |
| Knowlton, F. K. | Rochester, N. Y. |
| Lain, J. N. V. | Bangor, Me. |
| Lander, George B. | Concord, N. H. |
| Lang, Albion E. | Toledo, Ohio |
| Larned, Waldo A. | Newton, Mass. |
| Laughlin, F. M. | Pittsburg, Pa. |
| Laurence, A. | New York |
| Leslie, E. C. A. | New York |
| Libby, S. B. | Haverhill, Mass. |
| Lockwood, Thomas D. | Boston |
| Lyon, C. W. | Philadelphia |
| Mackie, Robb | New York |
| Magee, F. A. | New York |
| Mailloux, H. Jules | Philadelphia |
| Mainwaring, A. H. and wife | Philadelphia |
| Markle, A. | Hazleton, Pa. |
| Martin, T. C. | New York |
| Mason, L. T. | Hornellsville, N. Y. |
| Mason, J. H. | Boston |
| Mason, John A. | New York |
| McIntire, C. H. | New York |
| McLeer, John | Philadelphia |
| Mercein, Thomas R. | Milwaukee |
| Miles, Benjamin F. | Cleveland, Ohio |
| Minkwitz, Herman | Meriden, Conn. |
| Minte, J. Le Roy | Waterbury, Conn. |
| Mist, Le Roy S. | Waterbury, Conn. |
| Moses, George W. | Chelsea, Mass. |
| Mustard, A. H. | Pittsburg |
| Nichols, Edward L. | Ithaca, N. Y. |
| Nowotny, John S. | Cincinnati, Ohio |
| Osborne, W. F. | New York |
| Page, Dudley | Frederick, Md. |
| Paulson, A. B. | Philadelphia |
| Payne, Ralph W. | New York |
| Pease, A. H. | Hartford, Conn. |
| Peck, W. G. | Chelsea, Mass. |
| Peck, E. F. | New York |
| Perry, J. W. | Philadelphia |
| Phillips, Eugene F. | Providence, R. I. |
| Phillips, Frank N. | Providence, R. I. |
| Pierce, O. D. | Philadelphia |
| Pierce, W. E. | Bangor, Me. |
| Pillsbury, Edwin S. | St. Louis, Mo. |
| Platt, C. M. | Waterbury, Conn. |
| Pratt, W. L. | Adams, N. Y. |
| Price, Charles R. | New Bedford, Mass. |
| Price, Charles W. | New York |
| Proctor, W. L. | Ogdensburg, N. Y. |
| Purdy, C. J. | Canandaigua, N. Y. |
| Putnam, J. E. | Rochester, N. Y. |
| Pyle, James E. | West Chester, Pa. |
| Radfarph, F. H. | Quebec, Can. |
| Randolph, R. J. | Chicago |
| Redman, George A. | Rochester, N. Y. |
| Redpath, F. R. | Montreal, Canada |
| Rhotehamel, J. H. | St. Louis |
| Reilly, C. J. | Chicago |
| Richardson, J. O. | Philadelphia |
| Rielly, Lincoln S. | New Britain, Conn. |
| Rosenbaum, William A. | New York |
| Ross, Robert A. | Montreal |
| Royce, Frederick W. | Washington, D. C. |
| Russell, Charles J. | Philadelphia |
| Sadler, George W. | Montreal |
| Sampson, Frederick D. | Charlotte, N. C. |
| Sauerman, A. B. | New York |
| Schiffler, Frederick A. | New York |
| Scott, Charles E. | Bristol, Pa. |
| Scott, Charles F. | Pittsburg, Pa. |
| Scott, D. T. | New York |
| Seaman, J. F. | Uniontown, Pa. |
| Shaw, H. M. | New York |
| Shepardson, A. O. | New Britain, Conn. |
| Shonmaker, G. A. | Bristol, Pa. |
| Shryock, F. R. | Meadville, Pa. |
| Shultz, J. A. J. | St. Louis, Mo. |
| Smith, F. Ellwood | Somerville, Mass. |
| Smith, H. J. | New York |
| Spaulding, H. C. | Boston |
| Spencer, E. J. | St. Louis, Mo. |
| Sheldon, W. A. | Bryon, Ohio |
| Speer, J. S. | Sandusky, Ohio |
| Stanley, Henry D. | New York |
| Stetson, George R. | New Bedford, Mass. |
| Stevens, E. H. | Elizabeth, N. J. |
| Stieringer, Luther | New York |
| Sturgis, Irving J. | Houghton, Mich. |
| Sullivan, Edward | New York |
| Swetland, H. M. | New York |
| Tadham, George I. | Nashua, Vt. |
| Taft, F. | Brattleboro, Vt. |
| Tayler, Benjamin J. | Bristol, Pa. |
| Theobald, Adolph | Columbus, Ohio |
| Thomas, A. A. | Washington, D. C. |
| Tolles, C. L. | Hartford, Conn. |
| Townley, Calvert | Boston |
| Tremaine, H. A. | Fostoria, Ohio |
| Urquhart, Donald F. | Fremont, Ohio |
| Vail, W. A. | New York |
| Van Trump, C. R. | Wilmington, Del. |
| Venable, William Mason | Cincinnati, Ohio |
| Verity, P. B. | Shawnee, Ohio |
| Wade, E. E. | Colorado Springs, Colo. |
| Wason, Charles W. | Cleveland, Ohio |
| Waters, John C. | Mt. Morris, N. Y. |
| Webb, H. E. | Pittsburg, Pa. |
| Wentworth, Walter | Buffalo, N. Y. |
| Western, Benj. R. and wife | New York |
| Wetzler, Joseph | New York |
| Whitehead, Paul | New York |
| [illegible] | Chicago |
| [illegible] | New York |
| Williams, F. Ward | Philadelphia |
| Williamson, F. S. | Philadelphia |
| [illegible] | Chicago |
| [illegible] | Holyoke, Mass. |
| [illegible] | Chicago |
| [illegible] | Boston |
| [illegible] | Lansing, Mich. |
| [illegible] | Derby, Conn. |
| [illegible] | Syracuse, N. Y. |
| [illegible] | Waterbury, Conn. |

The Railroad Commission of the state of Mississippi in a circular calls attention of all telephone companies doing business in the state to the fact that they are not complying with section [illegible] of the code of 1892. This section provides that all telephone companies doing business in Mississippi shall make quarterly and annual reports to the railroad commissioners under like conditions as railroads, and are made subject to the same penalties for non-compliance. From Secretary Kimbrough it is learned the telephone companies have never made these reports. It is probable that the failure was caused from the fact that the privilege tax exempts them from all other taxation, but the railroad commissioners hold that this fact will not exempt them from making the reports, and it will require them in future to do so.

# THE CONVENTION

## Of the National Electric Light Association at New York, May 5-7, 1896.

On Tuesday, May 5th, the nineteenth meeting of the National Electric Light Association was convened at the Grand Central Palace, New York. The attendance was unusually large and much interest was displayed in the proceedings throughout. There were many familiar figures present during the several sessions, and no doubt many of the visitors were attracted to the meetings by the announcement of the presence of distinguished electrical scientists and inventors. It was noticeable, however, that there was no representative of the municipality present to extend a welcome to the delegates. Probably it was deemed superfluous after the brilliant exercises of the preceding evening, when the governor of the state formally opened the exhibition that is being conducted under the auspices of the association. At the opening session, Tuesday morning, President Wilmerding presided, and Secretary Porter was in his customary place. On the platform were three former presidents, James I. Ayer, Edward A. Armstrong and M. J. Francisco. The president called the meeting to order and said: "It has been customary when we have met before to be welcomed by some city official. On this occasion Mayor Strong is not able to be present and we must welcome ourselves." The president then proceeded to read his annual address, which is herewith appended:



GENERAL VIEW OF EXHIBITS IN MAIN AUDITORIUM OF THE ELECTRICAL EXPOSITION.

### PRESIDENT WILMERDING'S ANNUAL ADDRESS.

The National Electric Light association owes its birth to a meeting of those interested in the problems of electric central station lighting, held a little over 11 years ago, on the 25th of February, 1885, at the Grand Pacific Hotel in Chicago. Many of those who came together at that time are here to-day—a little older, it is true, and a great deal wiser in matters pertaining to the subjects they met to discuss; in fact, if we turn to the records of that first meeting we can but be struck by what, in the light of our present knowledge, appears to be the lamentable ignorance of those same gentlemen; and yet it must be remembered in their favor and in extenuation that they knew as much as could have been expected of them in those earlier days of electrical development. They meet to-day in their nineteenth convention, and those of you who will follow the proceedings will see that they have improved—it is only fair to give them this opportunity to vindicate themselves and I think I may add that you will find at the end that the improvement has not been entirely one-sided.

In these few years the central station for the production and dissemination of electric current for lighting and power has practically been developed, it barely existed in those days. It is needless to say that it enjoys a very vigorous and healthy life at the present time. It is, I think, without undue self-congratulation that we can say that the association has contributed its share to this progress and we, therefore, owe a debt of gratitude to those who met in Chicago, for even if they did know very little about electricity, they foresaw the wisdom of coöperation and the value of the free exchange of thought and ideas, which has made the association what it is today. The object of any such organization as this is primarily the advancement through mutual intercourse of its individual members; and, secondarily, the fostering and protection of their common interests. In both of these fields we can say with some pride that this association has, since its inception, steadily advanced, and with each year of its growth we have seen this it exerted a greater influence, that it afforded a greater opportunity for the acquirement of technical and practical knowledge, and that in proportion as it has become a stronger and more homogenous body, it has grown to be a greater necessity to central station interests. In this twelfth year of its existence we hope it may keep up with the steady improvement of former years and advance as nearly as possible in lock-step with the progress of electricity itself.

When our fellow countryman, Benjamin Franklin, flew his silken kite, an event which marks the first step toward present achievements, he drew from the clouds a tiny spark. That spark was then but like the twinkle of a star, billions of miles away. It hinted at the existence of an unexplored world, but so faintly that the most powerful telescopes of imagination failed to measure its dimensions or to determine its course. Gradually new facts were added, one by one, concerning this mysterious, distant star; it grew brighter; it was certainly coming nearer and nearer within the reach of man, but it was only a few years ago that it assumed the proportions of a body of the first magnitude, and so rapid has since been its onward progress that to-day that tiny spark has grown to a brilliant midnight sun, dispelling darkness throughout the civilized world. Such has been the meteoric course of the science which brings us here now. What in the days of our childhood was scarcely more than a toy—at best the interesting, the mysterious phenomenon of the scientist's laboratory—is in these closing years of the century the mightiest agent known to man. By its means the news of the world is gathered from its four corners in less than a second's time; yesterday it carried the command by which Governor Morton called the wheels of our exposition into life over six thousand miles, from the Atlantic to the Pacific and again to the Atlantic, at a touch of the finger and in less than the twinkling of an eye. Through its agency the softest whisper of the human voice is transmitted a thousand leagues, or recorded and preserved for the ears of future generations; the divisions of time are so integrated as to enable the eye to follow in reproduction the continuity of the most rapid motion, night is turned into day, darkness into light, the waste forces of nature are harnessed and wafted like spirits, unseen and instantaneously, over mountains and rivers, miles upon miles, to turn the busy wheels of distant industry, the hidden secrets of nature are laid bare by the ray that pierces dense matter with the ease of a shaft of sunlight traveling through thin air. One miracle has followed another until we can but wonder what apparent impossibility will be accomplished next. The fables and fairy tales of old pale before the facts of the present day.

Nothing could show more succinctly the various steps of this advance than the historical exhibit forming a part of the exhibition opened in connection with this convention, which we owe to the efforts of T. C. Martin, Mr. Morse and Park Benjamin. The literature of the science is shown from its earliest infancy, the crude original designs are there of apparatus which has since attained perfection, the gradual growth of many great

ideas is fully illustrated from their inception, and it is only necessary to turn to the other and present day departments to see them in their completed forms, and to realize the recent extraordinary achievements of electrical inventors. Supplementing this is the prolific exhibit from the Patent Office, an inspection of which can leave no further doubt as to the activity which has been going on in this field of science.

The last exhibition of this nature was the great display at the World's Fair at Chicago in 1893. Only three years have elapsed since then, and yet it can be plainly seen that in the meanwhile a sort of Darwinian evolution has been going on, developing things then unheard of and unknown, through the natural progeny of earlier germs, now fructified by the power and genius of the great minds that have fathered them.

The most recent of these triumphs of science, and the one which has attracted the most widespread interest and perhaps promises the greatest results in a scientific way, is the marvelous discovery of Prof. Röntgen the cathode or X-ray. Thanks to the courtesy of Thomas A. Edison the application of this strange light, the methods employed to obtain sciagraphs and the use of his newly invented fluoroscope, by which one can see, as through a stereopticon, the bones of one's own anatomy, are graphically shown and explained by the assistants from his laboratory.

Equally new to the world, and first brought forward by another of our distinguished honorary members, Nikola Tesla, are the beautiful and curious effects in lighting produced by high frequency, high voltage currents, which will be shown by D. McFarlan Moore as he has developed them and applied them to practical use. Mr. Moore, perhaps in a true spirit of prophecy, describes this as the "Light of the future."

Still another invention which has seen the light of day since the Columbian Fair, and also owes its origin to the fertile brain of Mr. Tesla, is the oscillator, by means of which unique contrivance much of the machinery now requisite for generating electricity is dispensed with, and current is derived directly from the energy of steam.

Although the mere transmission of current over long distances is not absolutely new in the sense that the expression must be taken in speaking of things electrical, for it dates back three or four years, yet all the features of the great example of such transmission shown here are individually novel, and the exhibit as a whole may be classified as one of the most significant of all. The generators producing the current at Niagara, as well as the turbine that actuates them, are the largest that have yet been built and successfully operated, and the two-phase winding of the former represents the latest advance in the construction of dynamos for the distribution of power. The line carrying the energy to this city traverses a distance of 462 miles, which is 347 miles longer than the celebrated Frankfort transmission, the longest hitherto attempted. The successful accomplishment of this feat is an indication of great future possibilities in the utilization of natural advantages for the supply of power over wide areas, and at the same time adds a further argument in favor of the rapidly growing tendency toward unification and centralization of generating plants.

A reference to those more strictly scientific advances in electricity leads to the consideration of its growth commercially. Figures are certainly the most convincing expression of the measure of achievement in this direction, and the following facts will carry with them their own conclusions:

About 17 years ago the first central station was established; at present there are 2,500 electric light companies in the United States, and about 200 municipal plants. These central stations represent an invested capital of $300,000,000. There are, in addition, about 7,500 isolated plants, which have required an expenditure of $200,000,000 more. An idea of the capacity of these 10,000 installations may be formed when it is known that there are produced daily for their use from 50,000 to 75,000 incandescent lamps; that the annual consumption of carbons in arc lamps is 200,000,000, and that 500,000 stationary electric motors are operated by the current which they generate.

The electric railway is of still more recent birth, dating back but 10 years, and yet at the present time there are no less than 900 such roads in this country, using 11,000 miles of track, operating 25,000 cars, and involving an investment of about $750,000,000; and this investment is increasing annually at the rate of $100,000,000 for new roads and new equipment. While these are large figures, they do not at all represent the total capital employed in electrical industries. The manufacturers of the apparatus and supplies used to carry on this enormous business, and the dealers who handle them, have at stake probably a sum sufficient to build and equip all the central station plants in the country; and if the auxiliary enterprises, such as those of the producers of copper, the makers of boilers, the engine and car builders, fixture manufacturers, glass workers, and a score of others, who depend in a large degree, and in some cases exclusively, upon the electrical trade, are considered, the grand total would reach a sum that any country might be proud of as a national debt.

This astounding growth affords a striking example of American enterprise as compared with that of the Old World. Against 900 electric railways in this country, there are less than 100 in all Europe; and as to electric lighting, the output of a single company in New York, or of a single company in Chicago is greater than the combined output of all the stations in the brilliant city of Paris.

The short period since our last meeting has in itself marked an epoch of the greatest importance in electrical engineering. The Niagara Falls power plant has been completed and put into successful operation. The first elevated electric railway, the Metropolitan of Chicago, has been opened for public travel, and has already demonstrated that such a road can be operated at about one-half the cost of a steam road, and making it merely a question of time, and a short one at that, before all elevated trains must be propelled by the same cleanly and economical means.

The first powerful electric locomotives of the Baltimore & Ohio railroad have been put into regular service in the Baltimore tunnel, drawing the heaviest trains, and furnishing an example which other railway companies are already preparing to follow. This is undoubtedly the first step toward a general revolution in the methods of transportation which will result not only in greater comfort and better service to the public, but in such a saving to the companies themselves as will place many a road now on the verge of bankruptcy on a prosperous and dividend-paying basis.

I am glad to be able to say that while everything else electrical has been forging ahead, the National Electric Light association has not been standing still. The report which will be submitted by the committee on rules for safe wiring and the committee on data will show that they have accomplished much valuable work during the past year. The progress which has been made by the former committee toward bringing about the general adoption of a national code of rules for electrical installation is especially gratifying, and we may at last hope that this much to be desired and long deferred result of their labors may soon be attained. We have all suffered from the lack of fixed standards governing electrical construction, and from the arbitrary rulings of self-constituted authorities on this very important subject, and the establishment of a board composed of competent and representative men whose rules will be consistent, and as far as possible permanent, is one of the greatest of our needs, the realization of which should be one of the first aims of the association.

GENERAL VIEW OF EXHIBITS IN MAIN AUDITORIUM OF THE ELECTRICAL EXPOSITION.

The report also of the finance committee will be found interesting and extremely satisfactory, showing, as it does, that our treasury is in a better condition than ever before.

We have been particularly fortunate in securing papers to be read before this convention upon subjects which are timely and of special interest to central station men; and I desire to take this opportunity to thank the gentlemen who have prepared them and who will read them for their willing coöperation with the officers of the association in their efforts to make this meeting a successful and instructive one.

I trust, gentlemen of the association, that you will all coöperate toward this result, at least to the extent of a regular attendance at our sessions, resisting while the convention lasts, if not longer, all the subtle temptations and seductive allurements of this fair city of Greater New York.

At the conclusion of the reading of the president's annual address the convention was formally declared open for the transaction of business.

REPORTS OF COMMITTEES.

According to the programme, the first order of business was the presentation of the report of the committee on rules for safe wiring, but the chairman, W. J. Hammer, announced that it had been deemed advisable to hold another conference before submitting the report, and consideration of this subject was accordingly postponed upon his request until Wednesday afternoon.

The president next called upon A. J. De Camp for the report of the committee on relations between manufacturing and central station companies, but that gentleman had no report to make. He said the committee had accomplished nothing, although it had been of long standing, and he asked that it be discharged. John I. Beggs opposed the motion and a lively discussion ensued, in which Mr. Beggs, Judge Armstrong, Mr. Francisco, Mr. Hammer, and Mr. De Camp participated and of which the following is a summary.

MR. BEGGS: I believe I have the honor, if such it may be called, of belonging to a committee that has never been called together, and how it is possible for the chairman of a committee to formulate a report and present it here, when the committee has never met in order to determine whether there is anything that might be accomplished between this association and the manufacturing or parent companies, is a very strange proceeding to me. I believe there is a great deal for some committee, or this association, if it does not act through a committee, to do for the central station companies in this country in connection with the manufacturing and parent companies. If there is not, what are we here for? I would like to know what the mission of the National Electric Light association is. What do we hope to accomplish by keeping it in existence? I consider the most important matter that can come before this association is the subject of the relations between ourselves and those from whom we are compelled—if we are to continue as we have done in the past—to obtain the apparatus with which we run our stations, and how we are to restrain these companies from placing apparatus in the hands of others who are doing everything in their power to wreck the business of the central station men assembled here to-day. I think the one thing in which there is room for this association to exercise its influence is just in this line of the relations between the central stations and the manufacturers; and, gentlemen, a fact of every recent occurrence would seem to indicate that the central station people of this country do want to get closer together, because of the example set by the close union that is being brought about by the larger manufacturers of this country, who, to a very great extent, are dependent upon the companies represented here today, who are spending hundreds of thousands of dollars annually in the purchase of new apparatus and in the purchase of supplies.

MR. ARMSTRONG: I never heard of the proposition that a committee was to be called together. A committee is formed so that the chairman can have additional dignity, that is all. The idea of supposing that the committee is to be called together is ridiculous. Have not we heard the announcement from the chairman of the other committee called upon for a report that he has been busy, and has not had time to make his report? He said, parenthetically, that he desired to get his committee together before making the final report; he gave that for an excuse. The chairman has got to have the members for an excuse; that is what they are for. Suppose I am not ready with my report? I lay it to the fact that the committee has not met. If I have my report ready, it does not matter whether the committee has met

(Continued on page 241.)

Western Electrician.
EVERY SATURDAY.

PUBLICATION OFFICES:
Suite 510 Marquette Building, CHICAGO.
TELEPHONE, MAIN 1746.

EASTERN OFFICE: 108 TIMES BUILDING, NEW YORK.

Trade Supplied by Western News Co.

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**SUBSCRIPTION**, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

**ADVERTISING.**—The WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *electrical centers trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

## HIGH WATER MARK
## CIRCULATION, 16,630.

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THE publication offices of the WESTERN ELECTRICIAN have been removed to much more commodious quarters. Our new address is Suite 510 Marquette building, Dearborn and Adams streets, Chicago.

The telephone number remains unchanged, Main 1746.

It now certainly be renewed confidence in commercial prospect when so much interest is manifested in a convention and exposition of the character of that opened last week by the electrical fraternity in New York. Expenditure of time and money is not made nowadays on the scale that marked the preparation for this gathering unless the participants anticipate returns that will amply repay them. There is reason, then, to congratulate the electrical industries upon this evidence of returning prosperity, and bid the timid spirits take heart and engage earnestly in the work of advancing the general interests of the fraternity. In no other industry does so much depend upon concerted action and general confidence as in the electrical trade. Each branch is depending upon the others, and prosperity or adversity in any particular line is soon communicated to every allied interest. On this account it is particularly important that earnest and united effort be made henceforth for general advancement in all branches of the industry.

LIKE all conventions of the National Electric Light association, the New York meeting devoted a good deal of precious time to long winded arguments which nobody cared particularly to hear. It must be confessed, however, that in this respect the late convention was an improvement upon former meetings. Several "time-talkers" kindly restrained their natural inclination to monopolize the attention of the gathering. As a result the proceedings are much more interesting and the views expressed far more representative. The association is to be congratulated.

A WORTHY cause has never been permanently advanced by unlawful methods. Resort to violence and intimidation is bound to react upon those who employ such means. This is a law-abiding, law-respecting community and a conflict between capital and labor cannot be settled satisfactorily where appeal is made to passion or prejudice. Aside from the merits of the controversy in the Milwaukee strike, the policy adopted of obstructing tracks and otherwise preventing the operation of street cars merits the censure of right-minded men.

THOSE who favor the construction of a Pacific cable under the control of this government may well feel encouraged by the advancement of the movement last week. It was feared that the controversy over the Spaulding and Seymser bills under consideration in the Senate would result in the defeat of the project, as the friends of each measure refused to give way to those of the other. On May 6th however, a compromise was effected in the committee on foreign relations which had both measures under consideration. The measure which Senator Frye was directed to report is in the shape of a bill directing the postmaster general to contract with the lowest bidder for the construction of a telegraphic cable between the United States and Japan by the way of Hawaii and the Midway Islands. It is stipulated that the price shall not be in excess of $600,000 a year for a period of 20 years, during which time and forever after ward the company shall carry government messages free of all cost. It is hoped that this will prove a practical solution of this perplexing question.

AN important decision was handed down in the Appellate Court on April 27th, reversing the findings of the Superior Court upon the question of the power of the city council of Chicago to regulate street railway fares in this city. The court holds that a street railway company is a common carrier of passengers for hire, that the Legislature has the power to regulate these charges and that that body delegated its authority in the premises to the city council. In support of this position the court cites numerous decisions, one of which is by the Supreme Court to the effect that "this is a rightful exercise of the police power." The proceeding in question was an action instituted by Nathaniel C. Dean against the Chicago General Railway company and was a test case, the plaintiff having been ejected from a car operated by the company for refusing to pay a fare of six cents demanded by the conductor under instructions from his employer. The plaintiff tendered five cents, the legal rate of fare fixed by the city ordinance, but the company through its agent refused to accept it, thus raising the question of the council's right to regulate the compensation due the street railway company. The court's decision is in line with the rulings of the Supreme Court in similar cases and it is generally believed that upon appeal this finding will be sustained. The result of this litigation has greatly encouraged those who are contending for material reduction in fares, and they have already renewed their efforts to secure the passage of an ordinance by the Chicago City Council fixing the maximum rate of fare at three cents. Residents of cities in other states are less fortunate, as they have to go to the Legislature for relief. In New York a bill was introduced during the last session of the Legislature to compel street car companies to sell 30 ride tickets for a dollar. In Ohio a bill extending street car franchises for 50 years contains a provision authorizing cities after 20 years to revise rates of compensation for carrying passengers. In Illinois it is contended, the people need not wait for the Legislature. The councils can regulate fares, but of course, existing companies will oppose any such exercise of authority. Their attitude toward the movement is indicated by the statement of Mr. Yerkes that the question of regulating fare is a part of the contract between the city and the companies and that the contract once in force cannot be amended unless the consent of the company is given.

CENTRAL station men who have been led to believe that the utilization of their plants for the manufacture of calcium carbide would redound to their benefit, should read the paper presented on another page this week upon the commercial value of acetylene gas. Mr. Ferguson presents the results of his investigation at Spray upon the cost of this product at that point and then applies the figures to the conditions that prevail at Niagara, and finally estimates the cost of production in large central station plants where the most favorable conditions prevail. The data here presented differs slightly from the estimates of others who have considered the subject purely in the light of a commercial enterprise, and the conclusion which Mr. Ferguson reaches is the one that forces itself upon every conservative man who looks at the subject from a practical view point. There have been so many impracticable suggestions made in connection with the subject, so many visionary schemes proposed, so much enthusiasm wasted over this discovery, that it is well to look at the matter calmly and consider it in the light of a business proposition to compete with present existing illuminating agencies. So many claims have been made for the new gas which upon examination have been shown to be without foundation, that a careful investigation of the entire subject cannot fail to be productive of great good. In the present case it may be said that Mr. Ferguson, an engineer of marked ability and recognized standing in his profession, has carefully and thoroughly investigated the subject, and the result of this examination and the conclusions which he reaches should be carefully considered by gas engineers as well as central station men. In this connection it may be well to direct attention to the announcement that acetylene will not be available as an enricher of ordinary illuminating gas, for the reason that experiments have shown that, while coal gas may be enriched by acetylene, water gas, which is used in all large cities, is not susceptible to enrichment by it. Probably the most important point made in the paper is that which disposes of the proposition to utilize existing central station plants for the production of calcium carbide. Mr. Ferguson points out that under present conditions it would be far more profitable for central stations to dispose of their electrical energy through incandescent and arc lighting than to attempt to utilize it in this way. The proposition to supply acetylene in liquid form to consumers in large cities is pronounced impracticable, and many excellent reasons are given for this conclusion. Aside from the inconvenience and annoyance that such a plan would entail, the danger in case of fire would of itself prohibit the use of cylinders in residences and business places, since the gas would escape should the cylinders become heated, and explosions of the mixture of acetylene gas and air would probably follow. Mr. Ferguson concludes that "acetylene, to be commercially successful, must be delivered to the customers in the form of gas through a system of mains, as is done now with ordinary illuminating gas." He adds that liquid acetylene should find a field in the lighting of country estates, railway trains, and for use in carriage, bicycle and locomotive lamps, and in isolated places where distribution by mains is not possible," but in large cities it cannot at present at least, hope to revolutionize existing conditions. In conclusion Mr. Ferguson invites consideration of the fact that acetylene, like all other forms of gas for illumination, is under a disadvantage in competing with the electric light, as the latter does not employ a flame, and this of itself he insists will prevent its general substitution for electricity. But this is not the only point of superiority claimed for the electric light over other forms of illumination. Despite these facts and numerous others the projectors of acetylene enterprises cling tenaciously to their belief in the merits of the new gas. That they have perfect confidence in their undertaking is shown by the manner in which they are pushing ahead their plans for the manufacture of calcium carbide on a large scale. Just what has been done in this line is set forth in the article by Mr. Dunlap in this issue. It is especially interesting in connection with Mr. Ferguson's article.

## The Western Electrician, The Convention and the Other Electrical Papers.

It is with no little pride that we call attention to the achievements of the WESTERN ELECTRICIAN in connection with the New York meeting of the National Electric Light association just closed. It was the first paper on the ground and the only one present at the inauguration of the exposition on Monday and the opening of the convention on Tuesday. It shou'd be remembered, in this connection, that the convention and exposition were held at the very door of the other electrical papers, while the WESTERN ELECTRICIAN had to travel a thousand miles to reach the convention city. That it should be first on the ground under such circumstances was an accomplishment fully appreciated by the public and especially by advertisers, as is evidenced by the many congratulations we have received.

The reading matter was the best of any of the papers, from the standpoint of a convention number, its symposium on conventions, illustrated with 32 portraits, being a characteristic and novel feature. No other paper spent as much money as did the WESTERN ELECTRICIAN to provide a handsome and readable convention number.

In the matter of advertising it eclipsed them all. This, perhaps, is a more remarkable achievement than the others, when it is considered that this was an eastern convention. The following table shows the number of pages of advertising carried by each of the principal electrical papers under date of May 9th (*Electrical Engineer* May 6th):

| WESTERN ELECTRICIAN. | *Electrical World.* | *Electrical Engineer.* | *Electrical Review.* |
|---|---|---|---|
| 72 | 58 (Small size). | 56 (Small size). | 25 |

Reducing this to square inches in order to eliminate from the comparison the difference in size between pages and rejecting all publishers' advertising in each case, we get the following:

COMPARISON IN SQUARE INCHES.

| WESTERN ELECTRICIAN | *Electrical World.* | *Electrical Engineer.* | *Electrical Review.* |
|---|---|---|---|
| 7,576. | 7,326. | 3,687. | 3,375. |

The WESTERN ELECTRICIAN's advertising therefore exceeds that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeds the combined advertising of the *Review* and *Engineer* by **514** inches.

The growth of the WESTERN ELECTRICIAN's convention advertising in pages and in square inches is shown by the following table:

| | No. pages. | Square inches. |
|---|---|---|
| Aug. 20, 1887 | 14 | 2,106 |
| Feb. 18, 1888 | 20 | 2,340 |
| Feb. 16, 1889 | 34 | 3,744 |
| Feb. 22, 1890 | 32 | 3,627 |
| Feb. 20, 1891 | 40 | 4,620 |
| March 5, 1892 | 32 | 3,744 |
| March 4, 1893 | 42 | 4,737 |
| March 3, 1894 | 40 | 4,145 |
| Feb. 23, 1895 | 52 | 5,503 |
| May 9, 1896 | 72 | 7,576 |

Outside of the steady average growth in the paper's advertising business there is nothing more significant in this 10 year's record than the 40 per cent increase of the last year.

## Features of the New York Gathering.

The assemblage of electrical men at New York last week was one of the most notable gatherings in the history of the National Electric Light association. The convention itself was interesting, the papers read were instructive, the discussions entertaining and in fact everything pertaining to the meeting was highly creditable to the gentlemen in charge of the arrangements. As a presiding officer, Mr. Wilmerding was eminently satisfactory and his annual address, printed in full on another page, will compare favorably with any similar production in the record of the organization. As indicated by the report of the proceedings which appears in this issue, the meeting was highly successful in every particular.

# THE CONVENTION

## Of the National Electric Light Association at New York, May 5-7, 1896.

*(Continued from page [illegible].)*

or not It never does I never understood that the committee consisted of more than the chairman, except for the incidental purpose spoken of While I am heartily in favor of what Mr Beggs says in relation to keeping up this line of work, I am not so sure but that the motion of Mr De Camp is in order We have had the committee standing for a long time under this title and name. Sometimes "familiarity breeds contempt." Sometimes when we become too much accustomed to a certain line it is well to change it, and therefore I shall vote for this motion that the committee be abolished, the name be abolished, and I shall vote also for Mr Beggs' motion that something else be substituted to do the work that this committee was intended to do

MR FRANCISCO At the Cleveland convention I called the attention of the members to the fact that there had never been anything done by this committee It was plainly understood and agreed at the time of the appointment of the committee that active work would be performed during the last year so that the committee could make a report at this convention. Mr. Beggs says there has been no meeting whatever of the committee. Therefore, I say, discharge the committee and drop the matter unless you can get somebody on the committee who will perform active work. This idea of putting on a figurehead and passing it along from year to year is nonsense

MR DE CAMP I do not know what may have been done at the Cleveland convention; but I do know what was the general sentiment when the committee was formed. The central station men individually did not seem to be able to cope with the manufacturer who for the time being was his enemy and made encroachments upon his business. Hence, the formation of this committee, whose duties were to confer with manufacturing companies in such manner as might seem to it to be most effective, with a view to reconciling the difference between the central station company and the manufacturing company. To bring about that condition, it was supposed that any member of this association having a grievance would make that grievance known to the committee, when it became the duty of the committee to make an appeal to the manufacturing company as the representative of this association. So far as my knowledge goes, the committee has never had a single communication from any aggrieved member of this association.

MR. HAMMER I should not like the good-natured remarks of Judge Armstrong to go on record without a word about our committee. This committee of ours is a working committee. We have five or six hundred letters from gentlemen interested in the subject in different parts of the country We have worked a long time, and as our president in his address referred to the conclusion of our committee's work, I think you will agree that the importance of it and the desire of presenting that report fully and thoroughly before you and not having it brought before you in any way in a superficial character, was the reason why it was deferred until to-morrow afternoon.

MR. BEGGS: A word of explanation is due in view of the remarks made by Mr. Armstrong, and also by Mr. De Camp. The gentlemen present at Cleveland must recollect that this matter was discussed at two or three different sessions of that convention and it was presumed, and it is not an idle presumption by any means, that there was a general grievance that applied to all the central station companies that should be taken up by an active, forceful, aggressive committee. If this organization of central station men from all parts of this country would take hold of the matter actively Mr. Francisco would not be compelled to sell arc lights at $2.33 per month, to burn until 12 o'clock every night in the year, simply because some company owned by these parent companies seeks to obtain franchises or the manufacturing companies desire to sell an additional outfit in that city

MR. ARMSTRONG: While I am broad enough to desire to benefit the whole community, I am also narrow enough to desire the special benefit of my own company. That is why I come to these conventions, and, I apprehend, that is the reason why you all come to these conventions. That is why my company pays dues into this association, and, I apprehend, that is why all of the companies pay dues in this organization; and it is absolutely true that this committee was formed with a specific purpose. Assaults were made in Boston, assaults were made in Rhode Island, assaults were attempted in Philadelphia, assaults were made throughout the Union by these companies that were desiring to sell apparatus, and which were organizing and fostering companies in opposition to us It was not the general thing, it was because of specific onslaughts made upon invested dollars that we gave attention to this matter. I am not only willing, but anxious, that some committee shall be appointed to carry out all that Mr. Beggs desires, and that the most drastic measures shall be resorted to in furthering the objects for which the committee is appointed.

The motion of Mr. De Camp was carried, discharging the committee, and the meeting adjourned until three o'clock

When the members assembled in the afternoon for the second session, President Wilmerding presented a number of letters, including several invitations for the visiting delegates. Nikola Tesla wrote to assure the association of his interest in its work and express the hope that the convention "would be a great success." Thomas D. Lockwood regretted his inability to attend the opening meeting, but expressed his intention of putting in appearance later. The American Surety company invited the delegates and ladies to visit the roof of its building from which a fine view of the city and surroundings could be obtained. The local Edison company offered to show members through its stations, and the Crocker-Wheeler company extended a general invitation to visit its works at Ampere, N. J., accompanying the invitation with railroad tickets which could be obtained upon application to the secretary The management of the Broadway theater sent word that the greater part of the orchestra and orchestra circle would be placed at the disposal of the delegates upon Wednesday night, which was termed "electric night." Notice was served upon the delegates that De Wolfe Hopper would take considerable liberty with electrical matters on this occasion.

At the conclusion of these announcements the convention settled down to business. President Wilmerding introduced Louis A. Ferguson of Chicago, who read the first paper of the meeting. Its title, "The Commercial Value of Acetylene Gas as an Illuminant," assured the speaker an attentive audience, and, as the subject was handled in a masterful manner, it received close attention throughout. At its conclusion the paper was discussed by Messrs. Beggs and Nicholls, the author was complimented upon his effort, a vote of thanks was adopted, and a resolution directing the immediate printing of the paper in pamphlet form for distribution among members was passed.

The next paper read was by H. F. Leonard and the title was "Single-phase, Self-starting, Synchronous Motors." In the discussion which followed, Messrs. Wagner, Van Trump, Ferguson and Leonard participated.

The last work of the day was the reading by A Churchwood of a paper on "Equalizer Systems of Distribution." Mr. Edgar closely questioned the author upon several points in this paper and Mr. Ferguson also took part in the discussion. As it was quite late when this subject was closed, the convention went into executive session and then adjourned until the following morning.

### Wednesday's Proceedings.

The morning session was occupied by the reading and discussion of Mr. Emmet's paper. The president called the meeting to order at 10:30 o'clock and the session continued until 1 o'clock. The title of Mr. Emmet's paper was "Results Accomplished in Distribution of Light and Power by Alternating Currents." As indicated by the title, the paper covered a wide field and presented many interesting points for discussion. Among those who participated were Messrs. Wagner, Van Trump, De Camp, Dow, Scott, Ayer and Emmet. At the conclusion of this debate, a letter from Professor Thomson was read, explaining that owing to an accident he would be unable to attend the convention. Much regret was expressed by members. It had been expected that Professor Thomson would make an address at the convention.

The afternoon session was presided over by First Vice-president Nicholls and considerable important business was transacted. The first paper presented was by Luther Stieringer, on "Evolution of Interior Conduits from the Electrical Standpoint." After tracing the development of this branch the writer gave 13 facts which he said the best experience of 15 years in interior wiring had demonstrated. The paper was supplemented by an appendix containing abstracts from a patent on "House Wiring for Electric Light" and an extract from a paper read by W. J. Jenks before the Insurance Congress at the World's Columbian Exposition in 1893.

Following this was a paper by John F. Kelly entitled "Some Account of the Evolution of the Inductor Alternator." Dr. Bell discussed the paper briefly.

At this point the report of the committee on wiring rules was presented. It contained an historical sketch of the appointment and preliminary work of the committee and brief reference to the proceedings of the conference at New York this year, all of which has been published heretofore. It was announced that future conferences would be composed of representatives of the following named bodies, if all the invitations are accepted:

National Electric Light association American Institute of Electrical Engineers, American Street Railway association, National Board of Fire Underwriters, Amer-

·can Institute of Architects, National Association of Fire Engineers, Underwriters' National Electric association, Factory Mutual association, American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers, American Society of Naval Architects and Marine Engineers, National Master Builders' association.

Associate Members (who will be admitted to conference but will not be entitled to vote); Western Union Telegraph company, Postal Telegraph company, American Bell Telephone company, Westinghouse company, General Electric company.

It was announced that through the courtesy of the American Society of Mechanical Engineers the building at 12 West Thirty-first street, New York, was made permanent headquarters, where communications of interest to the committee or conference may be addressed.

The committee urged the association to continue its representation in the national conference, by the appointment of an official delegate and making an appropriation of $25 for carrying out the incidental expenses of the conference.

This proposition was not entirely approved and subsequent discussion developed strong opposition to the plan, when Mr. Seely moved that the report be accepted, the thanks of the association tendered and the committee discharged.

Judge Armstrong opposed the suggestion of the committee, as he believed that it would deprive the association of its independence, which it has always been jealous in preserving. Mr. Ayer favored the proposition and Mr. Hammer explained that the association would not be committed by being represented in the manner suggested. Judge Armstrong continued his opposition and moved as an amendment to the committee's report that the president appoint a committee of five, which committee may designate some one to confer with the representatives of other bodies on the same subject. The amendment was finally carried.

Mr. Ayer introduced the subject of standardizing incandescent lamps. He said that it seemed necessary that some steps should be taken toward establishing an accurate standard. As to the details for the final accomplishment of this object, he suggested that it be taken up by some committee. He recommended that a committee be appointed to confer with representatives of the American Institute of Electrical Engineers, with a view to adopting some standard for incandescent lamps, so that all manufacturing companies may have a standard to work from, and all operating companies a standard to go by. This was done after some discussion.

Another topic which received considerable attention was whether an electric light and power company could be classified as a manufacturing concern. The gentlemen who participated in the discussion took the view that electric companies should be so considered, especially in view of the fact that gas companies were classified as manufacturing concerns, but Mr. De Camp called attention to the decisions of the state courts in Pennsylvania which ruled otherwise.

## Thursday's Proceedings.

As soon as the convention was assembled on the morning of the last day, a committee composed of Messrs. Armstrong, Leslie, Francisco, Giles and Huntley was appointed to consider nominations.

President Wilmerding's action in naming T. C. Martin to represent the association at Lord Kelvin's jubilee was approved.

Mr. Seely as chairman of the finance committee made a report, showing financial transactions during the year as follows: Receipts, $6,485.41; expenses, $5,746.76; balance, $738.65. The assets of the association are $1,792.94; active members, 111, associate members, 90. The report was accepted It was decided that the report of this committee hereafter should be made to include all financial matters up to within 30 days of the meeting. Later, Mr Seely, as chairman of the finance committee, made a supplemental report, in which he stated that the total cash on hand in the treasury of the association at the present time was about $5,000.

A letter from Edward H. Johnson of the Interior Conduit & Insulation company was read inviting the delegates to witness a demonstration of a new system of surface contact for street railways in the exhibition hall

The president named the following gentlemen a committee to confer with the American Institute of Electrical Engineers for the purpose of determining a standard candle power for incandescent lamps: Louis Bell, chairman James I Ayer and Louis A Ferguson

The president appointed William Brophy, chairman, C. R. Barnes, William J. Hammer, James I. Ayer and C. L. Edgar a committee of five on standard electrical rules. This committee may designate someone to confer with the representatives of other bodies on the same subject.

The report of the committee on data was then presented. The report was received and a vote of thanks extended to the committee. Mr. Armstrong also offered a resolution providing that the executive committee be directed to expend such amount of money as may be necessary to procure data from representative companies for the benefit of the committee. This resolution was adopted.

A letter from the United Electric Light & Power company was read, inviting the delegates to visit the new central station of the company at the foot of East Twenty-eighth street, New York.

Alfred Swan, who was down on the program to open a discussion on "A Standard Socket," was not able to be present, but sent an interesting paper on the subject, which was read and ordered published in the proceedings.

The paper by L. H. Rogers on "The Evolution of the Arc Lamp," was read. It was listened to very attentively, and created much merriment. At its conclusion Judge Arms rong said: "Some modest men behind me say that this is the cheeriest, prettiest and most interesting paper they ever heard at one of these conventions. I think we ought to do a little more than just move a vote of thanks to the author of this paper. We cannot say any more than that; but in making that motion I want it to be distinctly under tood, speaking for myself and those modest men in the rear, that I feel that the good suggested which may come from this paper is something that merits the heartiest thanks, not only of the electric light men, but the never-dying, ever-present, ever-active individual referred to in the paper—the taxpayer." The motion was carried. The president introduced Captain Brophy who delivered an address upon "Electrolysis," at the conclusion of which the meeting adjourned.

The president called the afternoon session to order at 3 o'clock. The first business was the paper by Albert A. Carey, on "Steam Boilers, Their Equipment and Management." Mr. Carey read the paper, which was in a somewhat incomplete state, and illustrated it with drawings on the blackboard.

The convention then went into executive session, whereupon the following resolution was adopted:

*Resolved*, That the executive committee be instructed to require that all papers to be read before the convention be first submitted for approval, and, if approved, that such papers shall be printed and placed in the hands of the members at least one week before the meeting, when such papers shall not be read in full, except by special order, that the time occupied by reading such papers may be devoted to the discussion of the papers.

The nominating committee presented the following names for the officers of the association for the ensuing year, and the selection of the committee was ratified:

President, Frederic Nicholls, Toronto.
First vice-president, Henry Clay, Philadelphia, Pa.
Second vice-president, J. J. Burleigh, Camden, N. J.
Members of the executive committee for three conventions, A. J. De Camp, Philadelphia; John A. Seely, New York, and A. M. Young, Waterbury, Conn. H. A. Wagner, St. Louis, was recommended to fill the vacancy made on the executive committee by Mr. Nicholls' election as president.

Mr. Wilmerding, the retiring president, expressed his gratification at the manner in which the convention had passed off, and thanked the members for their assistance in contributing to its success.

On motion of Mr. Seely the secretary was instructed to prepare a set of resolutions to the retiring president thanking him for the manner in which he presided over the meeting. Mr. Nicholls, the newly-elected president, put the motion, which was carried, and the meeting then adjourned.

## Notes From the Exposition.

Charles A. Schieren & Co. of New York have an elaborate display of their perforated belting.

Forée Bain was a familiar figure at the exhibition, looking, as usual, for conundrums in electrical science.

J. S. Crider was very much in evidence. He says you don't need to go to Germany for Helios carbons; try Pittsburg.

The Card Motor & Dynamo company of Cincinnati, Ohio, has one of its machines directly connected to a Payne engine.

"Bob" Randolph of the Excelsior company amused everybody with his entertaining series of apparatus-selling stories.

The American Watchman's Time Detector company of New York has various styles of clocks and indicators on exhibition.

The headquarters of the New York Insulated Wire company for the convention were at rooms 142 and 144 Murray Hill hotel.

The Phœnix Iron Works of Meadville, Pa., shows their latest type of high-speed engine directly connected to a Walker dynamo.

Little James Wolff was there, of course, with a souvenir Chicago button for everybody and a dose of the well-known Grimshaw brand.

The Carpenter Enamel Rheostat company of Hoboken, N. J., has a large display of various heating apparatus, which does it great credit.

H. Adams, New York manager of the Fort Wayne Electric corporation, deserves great credit for the arrangement of his company's exhibit.

The line of general rubber goods shown by the Columbia Rubber Works company of New York includes rod tubing insulators and telephone goods.

Pass & Seymour of Syracuse, N. Y., present an elaborate display of their porcelain at their booth. Their exhibit is in charge of J. D. McIntyre.

J. C. Vetter & Co. of New York make a pleasing display of numerous kinds of testing instruments, batteries and various small electrical apparatus.

The Straight Line Engine company of Syracuse, N. Y., has one of its new type of engines directly connected to the General Electric company's dynamo.

James I. Ayer, now of Boston, put in appearance. He is now exploiting the American Electric Heating corporation's apparatus. He says it's hot stuff.

The Stirling company of Chicago erected a full-sized boiler, showing the arrangement of its apparatus, which is the subject of much investigation by visitors.

The Niles Tool Works exhibit from Hamilton, Ohio, is in charge of E. D. Becker. The company has an extensive line of its various manufactures on view.

General Manager E. B. Hatch of the Hartford factory of the H. W. Johns Manufacturing company, renewed his many pleasing associations at the convention.

Fred Brown of the Electrical Construction company of New Haven renewed his acquaintance among the electrical trade during the session of the convention.

Henry B. Cutter of Philadelphia, who was recently in the West, stayed over to come east with the Chicago delegation. He knows a good thing when he sees it.

The Kennedy Valve Manufacturing company of 79 John street, New York, has a complete exhibit of their brass and iron body gate, globe, angle and safety valves.

R. D. Nuttall & Co. of Allegheny Pa., show a full line of their gears, pinions and trolleys and other work, in an attractive booth in charge of General Sales Agent F. A. Estep.

The A. A. Griffing Iron company of New York, which manufactures the Bundy tank steam trap, has an elaborate display of various sizes in Bundy traps and check valves

I. H. Babcock, treasurer of the American District Steam company, Lockport, N. Y., is one of the popular gentlemen welcomed at the exposition by his numerous friends.

George T. Eyanson of Eyanson & Armpriester of Philadelphia was a late visitor at the convention and exposition, where he renewed acquaintance with his many friends.

Frank Overbaugh of the General Fixture company of Chicago was in attendance, looking out for new things to add to his already extensive variety of supplies and specialties.

A model of the well-known Heine safety boiler located on the ground floor, in charge of H. L. Van Zile, New York agent, is an object of much interest to the delegates.

E. B. Latham, the enterprising New York manager of the Lakon company, was busy extolling the strong points of converters that convert and don't dissipate all the "juice."

The Gould Manufacturing company of Seneca Falls, N. Y., has a working exhibit of pumps which were handled in a manner which gives a complete idea of the apparatus.

The Chapin-Douglas Electric company of New York has a very complete exhibit of electrical supplies, attractively arranged about its booth, and has many calls for printed matter.

The Pennsylvania Slate company of New York has a beautiful exhibit of its productions for use among electrical men. The design and finish of the products are of very high quality.

Charles E. Gregory, the only second-hand electrical artist of Chicago, was present, but this time he was engaged in talking elliptical carbons instead of exchanging old lamps for new.

The Gold Street Car Heating company of New York has electric heaters for street cars, boats and buildings on exhibition, and presents many facts in regard to the excellence of the system

The Thompson Meter company of Brooklyn, N. Y., exhibits its new line of direct reading register instru-

ments. S. D. Higley is in charge and ably presents the merits of this apparatus.

The Wilkins automatic stoker of Bridgeport, Pa., used in connection with the Abendroth & Root boiler exhibit, shows the practical workings of this valuable apparatus in its best manner.

Ernest H. Heinrichs, the esteemed press agent and advertising expert of the Westinghouse company, was present and kept busy concocting "scoops" for his concern and entertaining his many friends.

The working exhibit of the printing telegraph system of John Burry of New York is a very interesting display. This system is now in use by the Western Union Telegraph company for stock quotations.

The Williamsport Wooden Pipe company of Williamsport, Pa., fills its space with a full line of its goods, gotten up to meet the various conditions met with in the incasing of underground cables, etc.

The Henry R. Worthington company of New York displays a large number of models and working exhibits of pumps, which are connected to various kinds of apparatus that showed unusual applications.

H. A. Wagner of St. Louis, the man with the biggest alternating station in the world and the well-known inventor of the Wagner transformers and motors, was around, full of pleasantries and information.

The New York Safety Steam Power company of New York has one of its medium-sized Worthington boilers on exhibition, for which much advantage is claimed on account of the large amount of heating surface.

The headquarters of the John A. Roebling's Sons company of Trenton, N. J., are arranged as a receiving room, with silk portiere curtains and hangings for the walls. No display is made of the company's wires.

W. F. Bossert of Utica, N. Y., shows his new cut-out junction boxes and also the new conduit boxes, both of which can be sealed and locked and therefore prevent any danger of tampering with them from outsiders.

General Manager A. A. Ziegler of Ziegler Bros. of Boston, Mass., spent a few days at the convention. It was the intention of this concern to have had an exhibit, but it was unable to do so on account of lack of time.

H. T. Paiste of Philadelphia was, as usual, doing that "everlasting hustle" for which he is so well known; there was something else besides samples of switches in his pockets; and knowing ones said they were good orders.

The G. A. Macbeth company of Pittsburg has a very attractive display of glass globes, and one special feature called "the shadowless," which is something new and attracts much attention. The exhibit is in charge of G. Miller.

The United States Prism Glass Globe company of New York has an attractive display of its numerous designs in globes, which give a peculiar diffusion of light, for use in electric lighting. The display is in charge of W. Pond.

The Electric Arc Light company of New York has a booth which receives an unusual amount of attention, because for the first time it presented its new Pioneer enclosed 100 hour arc lamp for inspection at an electrical convention.

The Diamond Electric company of Peoria, Ill., has a comprehensive exhibit of its different productions, showing the details of construction. The company's new transformers with capacity from 10 to 300 lights, are the feature of its display.

The Weston Engine company of Painted Post, N. Y., has one of its engines direct-connected to the new Warren alternator, which operates without moving wires, collecting rings or brushes, and is one of the features of the ground floor exhibit.

The Empire Self-lighting Oil Lamp company presents a novelty which attracts no little attention, being lighted by a small dry battery, hidden in the base of the lamp, operating in a satisfactory manner. This lamp attracted a great deal of attention.

The Ball & Wood company of New York shows one of its high-speed engines directly connected to a Siemens & Halske 100 kilowatt machine. This combination sets off to great advantage the high-grade workmanship for which these concerns are noted.

The General Incandescent Arc Light company of New York shows a cluster of six arc lamps, which were gotten up after the idea of a chandelier, surrounded by a sample of other designs in arc lamps, and a pyramid made of the Nuernberg arc carbons.

The American Electrical Works of Providence, R. I., through President Eugene F. Philips, C. R. Remington, Frank N. Phillips and General Sales Agent P. C. Ackerman of New York, extended a warm greeting to their friends at their New York office.

The convention headquarters of the American Circular Loom company at the Murray Hill hotel, were thronged out and in during the convention, by visitors, and the courtesy extended by this company made it one of the most popular resorts during the convention.

The Weston Electrical Instrument company of Newark, N. J., has a booth in which the walls and every conceivable space are covered with sample products. It is indeed a wonderful exhibit of electrical instruments, and it is such that it is doubtful if there could be a more complete exhibit presented in this line by any other concern in the world. Instruments from 10 milliamperes to 80,000 amperes will give an idea of the range shown.

Bailey Whipple, general sales agent of the Buckeye Electric company of Cleveland, Ohio, presided over his company's headquarters at the Murray Hill hotel. As usual, his general hustling abilities were seen by the many orders secured for the Buckeye lamps.

The Bernstein Electric company of Boston, Mass., has a working exhibit of its widely-known incandescent lamps of all colors and sizes, arranged in series and to work upon all systems for interior or street lighting. General Manager H. J. Cram receives the visitors.

The embroidery machine run by a Crocker-Wheeler motor in charge of the inventor, F. Heilich of New Rochelle, N. Y., is the object of much attention by the lady visitors. Very fine work is done and the souvenir, showing the work of the machine, is in great demand.

The O. S. Platt Manufacturing company of Bridgeport, Conn., was not able to arrange for an exhibit because of the rush of business. Said President O. S. Platt was one of the busy men of the show, and it is pleasing to note that the results of his work were many orders.

The Ajax lightning arrester, which is manufactured by C. S. Van Nuis of New York, was in great demand by purchasers at the convention. Its simplicity of construction, minimum discharge gap and maximum protection were strong arguments which made many sales.

General Manager H. J. Medbery of the Fiberite company of Mechanicville, N. Y., was one of the busy men in attendance at the convention. He was kept occupied in presenting pertinent facts regarding his company's celebrated products, and he reported a very large business.

The Vacuum Oil company of Rochester, N. Y., has the right man in Manager E. A. Record, in presenting the merits of its oils to the large number of visitors at its headquarters. Mr. Record, a genial, busy man during his short stay in New York. His large acquaintance in the electrical trade kept him hard at work in locating his numerous customers who made appointments with him.

The Sprague Electric Elevator company was not able to fully complete its exhibit last week by installing an electric elevator equipment, but this feature of the show is now in operation. It is a center of attraction, as for the first time the apparatus of an electric elevator is shown.

The Bi-Metallic Electric Transmission company has its headquarters with the John A. Roebling's Sons company, where samples of its wire are given to all who desire it. Vice-president W. N. Miner and Secretary W. Stanley Eckert present a warm greeting to a large number of callers.

General Manager C. E. Trump of the Novelty Electric company of Philadelphia was a visitor at the convention, and expressed himself as being pleased with the general display. He stated that he considered the power and lighting exhibition, for its size, one of the best ever made.

The E. G. Bernard company of Troy, N. Y., is distributing attractive circular matter, including testimonials to the excellence of its apparatus from prominent firms in the country. Egyptian cigarettes, which Mr. Bernard presented to the favored ones, were eagerly sought after.

The Bradford Belting company of Cincinnati, O., has a large display of Monarch insulating paint and leather belting and also a display of samples showing the efficiency of the Monarch insulating paint under severe conditions. Elmer P. Morris and O. M. Hubbard represent this company.

General Manager H. J. Gorke of the Electric Engineering and Supply company of Syracuse, N. Y., was able to spend but a short time at the convention because of pressing duties at home. He reports doing the largest business in several years, with bright prospects for the future.

General Manager Hawks of the Anchor Electric company of Boston, Mass., is one of the very busy men about the exhibition hall. The large exhibit which is under his immediate supervision, together with the greeting of his large number of business friends, consumes a large share of his time.

Horace See of New York has an interesting exhibit of an electrical indicator system especially designed for use on steamboats, to be used as a warning of the failure of any electric light to burn in any portion of the ship, whereby a bell is sounded and an indicator locates the position of the defective lamp.

The headquarters of the Mica Insulator company and Eugene Munsell & Co. of New York, are located at the same booth, where an extensive display of large mica rings, which are to be sent to Switzerland, Skeleton commutators and armature rings of all sizes and description are on exhibition. Samples of micanite gotten up for all classes of trade are presented to visitors, with attractive circular matter, by Charles W. Jefferson and E. C. Wood.

General Superintendent S. G. Booker of the Phoenix Carbon Manufacturing company of St. Louis, Mo., was in evidence everywhere, and the genial hospitality usually extended at his headquarters was, as usual, second to none. A convention without Col. Booker would have an element of social enjoyment missing.

The Watertown Engine company of Watertown, N. Y., shows one of its latest high-speed engines, direct-connected to an Eddy 50 kilowatt multipolar dynamo, demonstrating that perfect action for which this engine is so well known. President Bagg from Watertown was in attendance during the convention.

Edward Sullivan, superintendent of construction for the eastern office of the Standard Underground Cable company, is at the Standard booth, shaking hands with his many western friends. Mr. Sullivan was formerly electrical inspector of the Chicago fire department, and is well known to the western fraternity.

The genial face of Thomas K. Mercein of Milwaukee, the secretary of the Northwestern Electrical association, was everywhere in evidence. Mr. Mercein was a fraternal delegate to the convention from his association, and he took back many points for use at the coming summer convention of the Northwestern.

The Metropolitan Telephone & Telegraph company of New York gives a working exhibit of the local and long-distance telephones. Public booths and a complete subOffice of this company are established, and a large corps of obliging gentlemen shows the practical workings and mechanical construction of the telephone.

Colonel T. H. Brady of New Britain, Conn., one of the original members of the National Electric Light association, presided over the exhibits of the Brady Manufacturing company, and was surrounded continually by his old friends and acquaintances, who left numerous orders for the new Brady arc cut-out.

"Kerite" is the word so long known as identifying this high grade of wire, which received the only medals at the World's Fair for rubber insulation; and a most cordial greeting was extended at the headquarters at the Murray Hill hotel, to the visiting delegates. W. R. Brixey, general agent, J. E. Ham and E. H. Stanley.

The New York Carbon Works have a complete display of their various line of carbons, in charge of General Manager George W. Mills and Wm. Mills. They make the important announcement that they have recently purchased the Berliner patent for porous carbons, and are now ready to supply the trade in any quantity.

The Adams–Bagnall Electric company of Cleveland, O., has a large and attractive exhibit of its various arc lamps, including everything that can be asked for in this line, fitting all cases and circumstances required. General Manager L. H. Rogers greeted many friends, assisted by the eastern manager, A. J. Dorman.

The handsome wall space where De Veau & Co. of New York show their line of telephone and electrical supplies is a place that interests a large number of the visitors. A model of the firm's switchboard, showing the method of handling from two to 1,000 subscribers, is shown. There is a large demand for the De Veau catalogue.

General Manager Jones of the Quaker City Electric company of Philadelphia spent a day at the convention, and expressed himself as being greatly surprised at the excellence of the exhibits shown. He regretted that his company could not have made a display of electrical apparatus on account of large number of orders on hand.

The Goubert Manufacturing company of New York has a prominent location where models and photographs of its Stratton separator are shown, and convincing arguments are given to the visitors to show how this apparatus will avoid accident and the break down of an engine, being a positive safeguard and source of economy.

Abendroth & Root of New York exhibit the steam boilers that are in use as a working exhibit at the exhibition, consisting of 500 horse power, and are doing the work which has always been claimed for their apparatus. They have a large corps of salesmen whose time is constantly taken up in explaining the merits of their boilers.

Queen & Co. of Philadelphia had not expected to make an exhibit, but at the last moment they secured space on the annex floor, where a good general display of their various instruments may be seen. The new arc light photometer is carefully investigated by central station men, who pronounce it one of the necessities of their business.

The commutator bars and other necessary things in tempered copper exhibited by the Forest City Electric company of Cleveland, O., tastefully arranged upon a large board at its booth, excite much favorable comment from delegates and others interested in this class of work. Strong statements are made for the purity of this production.

The Lewis Tool company of New York, which is one of the largest manufacturers of vises in the world, has one of the most complete exhibits that can be imagined in this line, from the midget bicycle vise, up to the rolling mill vise which weighs 222 pounds, 64 different styles in all. The exhibit is in charge of M. G. Lewis and J. B. Cary.

The booth of the Standard Paint company of New York is a general rendezvous. It is a handsome affair,

gotten up with white and blue bunting with wood trimmings striped with gold. The compounds, paints, tapes and insulated paper are arranged in an attractive manner, while the company's various medals and diplomas are hung about the walls.

The office and store of the Phœnix Interior Telephone company are now located at 123 Liberty street, New York city, where the company is showing its telephone apparatus in an attractive manner. A large number of the visitors at the convention called and examined these telephones with a view of purchasing, and a large number of orders were taken.

The Bishop Gutta Percha company of New York has a very complete exhibit of different kinds of wire, showing also the pure Para rubber, and from it the company's various compounds as applied for insulation. Sections of large cables installed in numerous places in the country are shown. H. D. Reid and E. L. Hartpence have charge of the headquarters.

President J. Brodie Smith of the Brodie Electric company of Manchester, N. H., did not have a display of his well-known apparatus, but a number of samples which he showed at the Murray Hill hotel resulted in the securing of a number of orders. Mr. Smith is also the manager of what is called "the model electric lighting plant" of New Hampshire.

Secretary Franklin B. Platt of the Ansonia Electric company of Ansonia, Conn., was a close investigator of the various displays in the exhibition hall, and made two trips to New York in order to become thoroughly posted regarding the scientific displays. He states that business during March was very large, while that of April showed a further increase.

The Washburn & Moen Manufacturing company of Worcester, Mass., has a very large space devoted to the showing of its numerous lines of manufacture. Several showcases are filled with beautiful designs of wire, while numerous large reels of cables and new style trolley wire are arranged about the display. The booth is decorated with flags and bunting.

The Gordon-Burnham Battery company of New York has one of the most complete displays of batteries ever seen, together with a working exhibit of annunciators and telegraph and telephone instruments, fire alarm apparatus and Geissler tubes. Vice-president R. W. Gordon, Secretary F. A. Burnham and W. C. Banks are kept busy in explaining details.

The Manhattan General Construction company of New York was rushed during the week at its New York office, in showing Manhattan enclosed 100 hour arc lamps, and the strong statements which are made for it were of great interest to the central station men who called, and not a few orders were placed by them with General Manager J. Marsh Young.

The complete exhibit of the J. H. McEwen Manufacturing company of Ridgway, Pa., showing one of the engines connected with a Thompson-Ryan dynamo, attracts much attention, this being this company's first presentation of its apparatus at an electrical convention. It received a large number of complimentary comments upon the excellence of the showing.

The Hart & Hegeman company of Hartford, Conn., although it has no exhibit, is in evidence everywhere about the exhibition hall and the Murray Hill hotel, as President Gerald W. Hart and Secretary A. H. Pease are in attendance. Their stay was extended because of the many calls upon their time in arranging for orders given for the well-known Hart switches.

Dale, Farrell & Co. of New York have a booth fitted with their goods, including special magneto call bell, extension bell and Volta primary battery. Their new X-ray electric bicycle lamp, however, is the feature of their exhibit, and the supply of printed matter descriptive of this lamp was nearly exhausted on the second day of the exhibition; large sales were made of it.

The Babcock & Wilcox company of New York has a very original exhibit of boilers, arranged in sections about its large exhibition space. An electric sign and numerous photographs and various fittings of the apparatus make up one of the most artistic booths of the exhibition. The call for printed matter shows how well the name is known among the electrical trade.

The Washburn & Moen Manufacturing company could not have selected a more popular man to welcome its friends than Chas. W. Bassett, a gentleman who has been for so many years identified with the electrical trade and one who is known throughout the electrical fraternity. He reports a very large business in covered wire, showing a large increase over that of last year.

Miss H. Billings, the assistant secretary, was, as usual, the right person in the right place. Her long term of service with the association has familiarized her with its details of conventions, and this knowledge is of great value to the delegates and persons having business with the secretary's office. Her cheerful courtesy at all times and readiness to assist impartially all who ask favors are appreciated by visitors.

The Fuel Economizer company of Matteawan, N. Y., is located in a prominent position on the ground floor, where numerous photographs and working drawings are shown of the well known apparatus. The New York agent, William Downs, answers the numerous questions in regard to the advantages of the fuel economizer, and the conversation generally ends with a request for a catalogue, to which he adds a very pretty souvenir of a combined leather card case and memorandum book. General Manager J. F. Blackburn was in attendance during the convention.

General Manager W. C. Ballda of the Utica Electrical Manufacturing & Supply company spent a week in New York, and reports much benefit from his visit to the exposition, more so than from any previous convention which he had attended. He states that his concern is rapidly extending its business in all directions; a number of electrical novelties are under way which will soon be ready for sale.

F. J. Medbury, general manager of the insulated wire department of the J. A. Roebling's Sons company of Trenton, N. J., received his friends at the Roebling's headquarters. His experience and practical knowledge of the wire business have been shown in this firm's manufacture of late, and it was not surprising to hear that thus far the sales of this department have far exceeded those of last year.

H. E. & C. Bax'er of Brooklyn, N. Y. had a representative who was busily employed in giving directions as to where their factory could be reached, at which place the practical demonstration of tneir bells and various electrical supplies were shown. Their goods are well known and they did not consider it necessary to make an exhibition when they are at present so rushed to meet orders.

W. S. Hill of Boston, Mass., was a welcome visitor to the convention. Being one of the veterans of the electrical trade, he was surrounded a large share of the time by his many friends. Mr. Hill was a close investigator of the various exhibits and stated that, from an educational standpoint, the exhibition of electrical apparatus is one of the best ever shown in the country, and that he had seen them all.

Stanley & Patterson of New York exhibit one of the most complete lines of general electrical equipment to be seen in the hall in a booth decorated in a very original manner. The pillars and ceiling are decorated with incandescent lights in different styles and colors. This is the only electrical supply house in New York having an exhibit. A. F. Stanley and G. L. Patterson are in constant attendance.

The American Electric Heating corporation of Boston, Mass., has a large space filled with every conceivable device for heating, and the practical demonstration of expert cookery keeps the space in front of their exhibit crowded at all times, when the exhibition is open. The New York manager, Levi L. Parsons, has a most obliging corps of assistants, who explain in detail the workings of the apparatus.

The National Carbon company of Cleveland, O., has the right man in the right place in General Sales Agent M. M. Hayden, who arranged a very elaborate display of carbons. It is claimed that everything in the way of a carbon is shown by sample at this booth. A large number of old acquaintances in the electrial trade extended their congratulations to Mr. Hayden for the fine exhibit which was presented.

The Fort Wayne Electric corporation of Fort Wayne, Ind., has a very fine exhibit on the ground floor of an 80 light 2,000 candle power arc dynamo, connected to a Brush multipolar motor, which furnishes current for a bank of 80 arc lamps in a group in the corner of the ground floor, which presents a dazzling effect. The company has also a 25 kilowatt machine directly connected to a Woodbury engine.

General Manager F. S. Marr of the Helios Electric company of Philadelphia spent two days at the convention in renewing his acquaintanceship among the central station men. His company did not make an exhibit of their full line, but the samples which were shown by its New York agents, the Peck Electrical works, were all new and had many novel features. Mr. Marr and his company are never behind in the procession.

The Anchor Electric company of Boston, Mass., has a splendid display of switches and lamp adjusters, and also showed a new incandescent lamp-sign advertising device and mechanical gongs. The arrangement of the advertising sign over the booth was the subject of much favorable comment. This exhibit is most attractive. Vice-president Norman Marshall, General Manager H. C. Hawks and A. B. Field are in charge.

The leading feature of the Fort Wayne Electric corporation's exhibit is the self-starting single-phase alternating current motors, the working of which is explained by Prof. F. H. Leonard, Jr. It has various sizes of these motors at work, and they are one of the novel features in the exhibition hall. An exhibit of Wood transformers, ammeters, voltmeters, etc., makes a comprehensive display. Various catalogues and descriptive matter are presented to visitors.

The calculagraph is without doubt a leading feature of the exposition. The booth is constantly surrounded by people interested in investigating the merits of this device for keeping exact time, which can be applied in most every line of business. The Calculagraph company, whose headquarters are at No. 2 Maiden Lane, New York, is represented by President Henry Abbott, Treasurer E. A. Currier and F. Stanley.

The Joseph Dixon Crucible company of Jersey City, N. J., has a complete line of graphite, for use in the electrical trade at its booth. Graphite resistance rods were one of the strong talking points of Fred Engelbrecht, who has charge of the exhibit while an assistant presents a mammoth pencil, which is called the "Uncle Sam" to all who apply. The many electrical uses of graphite are courteously explained.

The Electric Selector & Signal company, at its office and factory, 43 Cortlandt street, New York, had an attractive exhibit of automatic cutouts, telegraph selectors, police and fire alarm signals, and General Manager P. H. Alexander, aided by a large corps of assistants, was rushed at times showing the apparatus. It was a fine display and it was regretted that the company was unable to locate in the exhibition hall.

The exhibit made by A. O. Schoonmaker of New York contains some of the largest solid sheets of East India mica ever shown. These are objects of curiosity and attract a great deal of attention. This stock is all imported direct from original sources in India, and is guaranteed to be of the highest grade and purity, being perfectly free from iron and thus insuring non-conducting properties. This exhibit is complete in everything regarding mica.

The Peru Electric Manufacturing company of Peru, Ind., although late in arrival, arranged a booth which attracted general attention for its beauty of design, with a striking presentation of its various porcelain specialties. It was the general comment that nothing in this line of manufacture was forgotten. General Manager R. H. Borislog and Superintendent D. A. Schutt were in charge of this company's headquarters.

The Ferracute Machine company of Bridgeton, N. J., whose presses and dies are so well known in the electrical trade, has a press especially designed for notching armature disks, directly connected to a motor. The company's catalogue, showing over 300 different designs in presses for all kinds of mechanical work, is in demand. President Oberlin Smith, Secretary F. F. Smith and W. S. Mitchell give information regarding this apparatus.

The auto-telephone system, which is manufactured by the Tucker Electrical Construction company of New York, is located in a booth especially designed to meet the requirements of a telephone exhibit. The various designs of this instrument—desk sets, hotel telephones, etc.,—are attractively displayed. President James R. Strong spends much time at the exposition. He is assisted by W. A. Moore, and the two are kept busy in explaining the workings of their telephone.

The United Electric Improvement company of Philadelphia has a working exhibit of its reactance system of arc lighting, in charge of the inventor, W. S. Horry, the electrician of this company. A handsome design of the company's well-known Keystone incandescent lamps, in connection with its arc lamps, attracts a great deal of attention. Vice-president and General Manager Walter F. Smith is in attendance, assisted by his son, Eugene Smith, assistant electrician of the company.

The Holtzer-Cabot Electric company of Boston, Mass., has a splendid location for its extensive exhibit of motor fans and direct current ceiling fans. The light weight of these fans caused much comment, as the company guarantees none would weigh over 30 pounds. The company's full line of motors and general supplies were also on view. President C. W. Holtzer and C. E. De Lue of Boston and the New York manager, David Chalmers, are in charge of the exhibit.

The Varley Duplex Magnet company of New York makes one of the most complete exhibits of magnets ever seen. Everything that one could desire in this line is shown. This concern from a small beginning has developed a very large business, and is becoming known East and West for the excellence of its products. General Manager Richard Varley is in charge, with several assistants, and a number of fine contracts have been taken.

The Ball Electric Light company of New York, on account of some changes made in the extension of its manufacturing facilities, did not think it would make an exhibition of its apparatus, but did so at the last moment, and presents a very pleasing exhibit, having a 100 light 2,000 candle power machine and several arc lights arranged in a booth. Secretary J. S. Bell is to be congratulated for what this company did in the short time available.

The Bryan-Marsh company of New York has a booth which for unique design as well as the practical showing of their incandescent lamps is one of the attractions of the exhibition. It has arranged in beautiful designs, incandescent lamps of various sizes, colors and forms. The book entitled "The Fashioning of a Lamp" presented to visitors is a work of art and one of the finest catalogues which has ever been presented at an electrical convention.

"To Our Friends" is the title of a neat little pamphlet distributed by Eyanson & Armpriester of Philadelphia at the exposition in lieu of a personal appearance. As they explain in their book, these gentlemen are so busy attending to orders for their switches, switchboards and tablet-boards that they were unable to get away from the Quaker City. They honestly believe that to-day they have the best equipped plant for the exclusive manufacture of switches in this country.

The Diehl Manufacturing company of Elizabethport, N. J., has a large booth which catches the eye. Two large brass column fans connected with a solid brass cast sign, very highly polished and decorated, make a most imposing entrance. The booth is filled with different styles of arc lamps, column and ceiling fans, arranged in a manner for practical demonstration of each, while the ceiling electroliers with fine attachment of latest de-

sign and beautifully decorated, presents a most striking effect. Electrician C. J. Knight, assisted by R. G. Clark, has charge of the exhibit.

The Cutter Electrical & Manufacturing company of Philadelphia, Pa., has a booth which is trimmed in an elaborate manner, and about which are located its circuit breakers and celebrated C. S. flush switches. It has a complete working exhibit of its manufactures, which is presided over by President H. B. Cutter assisted by A. E. Newton, W. E. Harrington and S. L. Nicholson. A souvenir of a blotter with a handsome cover of leather was presented to callers.

The Boynton Multivolt Battery company of New York has an exhibit of 50 batteries which attract much attention from visitors, because of their peculiar construction and great power. Various appliances are shown where this primary battery cell can be used for surgical operations, etc. Vice-president Chas. H. Brigham is in charge of this exhibit, and every moment of his time is taken in presenting the merits of this battery to an audience that constantly surrounds the booth.

General Superintendent J. F. Blaisett of the New England Butt company of Providence, R. I., which is so well known in the electrical trade for the excellence of its winding machines, could only spend one day at the convention, but he crowded in an unusual amount of work in that time. Arrangements were about perfected by this concern to show its apparatus, but it was prevented because of several rush orders which came at a time when it could not arrange matters satisfactorily.

Tuerk's alternating current ceiling fan, manufactured in Fulton, N. Y., has the honor of being the only alternating ceiling fan in the exhibition hall, and it is of great interest to the numerous visitors that constantly surround it. The Tuerk direct current ceiling fan also catches the eye of many persons, as shown by the orders. General Manager J. C. Hunter and the company's electrician, Samuel O. Tuerk, are in attendance. The exhibit itself is in charge of their general eastern agents, E. B. Latham & Co.

The Crouse-Tremaine Carbon company of Fostoria, O., has an elaborately decorated booth of Turkish design in red velvet, trimmed with a heavy gold fringe, tastefully festooned about the doorway and interior walls; at the back is the company's trade-mark in the center of an elaborate festoon of American flags. The display of cored and solid carbons, arranged in many different designs, makes an exceedingly attractive exhibit. President J. B. Crouse and Secretary H. A. Tremaine are in charge.

The celebrated Schiff carbons, manufactured by Schiff, Jordan & Co. of Vienna, are in evidence everywhere, and the colors of Austria and the United States are displayed. John Jordan is visiting the exposition from Vienna and presenting many pertinent facts regarding his carbon. President Ralph Shainwald, assisted by General Sales Agent F. S. De Ronde, F. F. Vandewater, J. N. Richards, H. W. Benedict and John Langan, extends that warm hospitality to visitors for which this concern is so justly noted.

The Electra carbons are located in a prominent booth and are the subject of much comment from visitors. A full line of direct and alternating current, search-light and crown microphone carbons (used solely in the 100-hour enclosed arc lamps) is arranged in a tasteful manner, and on the walls are shown a number of fine photographs of the factory at Nuernberg. A souvenir in the shape of a celluloid calendar is much sought after. H. Sutor, one of the experts of this company, assisted by F. W. Nolker, has charge of the exhibit.

The Warren Electric company of Chicago and New York displays on the first floor one 60 kilowatt Warren alternator of 9,000 alternations per minute, connected for 110 volts, of its latest induction type. This machine was much talked about by the practical central station men. There is also one 45 kilowatt Warren alternator of the same general style. This machine is having a large sale although only recently put on the market. It is exciting the admiration of all electricians for its high efficiency and close regulation. These machines are in charge of Wendell & MacDuffie and H. P. Hill.

The Standard Underground Cable company of Pittsburg exhibits reels of its standard fiber insulated cables, standard paper insulated cables and standard rubber insulated cables, with samples of some of its more important recent contracts; it has a show-rack for wires and cables and small samples, especially of lead-covered cables for distribution. The following named representatives of the company are in attendance: Manager G. L. Wiley of New York, General Superintendent W. A. Conner of Pittsburg, Edward Sullivan and A. B. Saurman of New York and J. R. Wiley of Chicago.

The Columbia Incandescent Lamp company of St. Louis has one of the most artistic incandescent signs which has ever been gotten up, and also an illuminated sign of the late Henry Goebel and a case containing the different materials used in the construction of lamps. It has a full line of both regular and special lamps, arranged in various designs, and in the center of a large table is a greeting "1896" in miniature lamps. President J. H. Rhotehamel and Secretary A. O. Garrison were in attendance from St. Louis. C. E. Bibber, the New England agent, is also greeting his many friends at this booth.

M. M. Hayden, superintendent of the electrical department of the National Carbon company of Cleveland, O., had a great surprise for his many friends at the convention. It seems that he was in St. Louis on business when imperative orders were received for him to go to New York and take charge of the exhibit. Having arranged to be married in June, he telegraphed his fiance, Miss Quine of Cleveland, and hastened matters so effectually that he was married immediately on his arrival in Cleveland on Wednesday night, leaving a few hours after for New York. Mrs. Hayden is prominently known as a church singer in Cleveland.

The Shultz Belting company of St. Louis, Mo., has a prominent location very tastefully arranged, with its line of belting, but the most unique thing in connection with this exhibit is a working model of its well-known trade mark of "Belting the Universe," which is skillfully arranged and run by a motor, and was the subject of much favorable comment. This concern furnished all the belt used by the two engines on the ground floor. President J. A. J. Shultz of St. Louis spent last week in New York and renewed acquaintance with his numerous friends. New York Manager A. B. Laurence is in charge of the exhibit.

Huebel & Manger of Brooklyn have a location at the right of the main entrance which no visitor ever passes without pausing to comment on the beautiful arrangement of their bells and push buttons, which are enclosed in a large and handsome oak case. The 15 inch gong, especially toned to be heard through a hotel or large building, for fire alarm purposes, is one of the features of this display. The skeleton frame bells are a novelty which attract much attention. W. W. McChesney, general sales agent of this concern, hurried home from California, where he had a most successful business trip, in order to take charge of this exhibit.

The Crocker-Wheeler Electric company shows its direct-connected and belt driven dynamos and a line of motors both in its space on the main floor and in the power plant on first floor. A number of motor-dynamos, brake motors, and special "mill" motors, also a number of automatic starting, controlling and reversing boxes are shown. On the first floor the company has a 55 kilowatt dynamo belted to a New York Safety Steam Power company 13 by 12 inch auto-cutoff engine. The Crocker-Wheeler company is represented by H. L. Lufkin, the general manager, and F. B. De Gress, and in the power plant by Mr. Tewksbury of the New York Safety Steam Power company.

The Wagner Electric Manufacturing company of St. Louis, Mo., shows a complete line of Wagner transformers from the smallest up to an 800 lighter, and a line of its interior type of transformers and special transformers, arc lamps and economy coils also attracted no little attention from central station men. A souvenir of a brass transformer inkstand was one of the finest things that was presented at the convention, and the call for it soon exhausted their supply. Representatives Eugene H. Abadie and A. J. Wagner deserve great credit for the manner in which their exhibit is shown. Many orders were left by purchasing agents who visited their headquarters.

The Eddy Electric Manufacturing company of Windsor, Conn., through its New York agents, H. B. Coho & Co., installed one of the most attractive working exhibits of the exhibition, being one of its 40 kilowatt multipolar direct-connected dynamos to an Ideal automatic self-oiling engine both of which are resting on three steel points, raised five inches from the foundation, being in no way bolted. This combination attracts great attention, because there is no perceptible vibration or jar when under any rate of speed. Secretary A. D. Newton and General Manager M. E. Baird of this company are exceedingly busy men in extending that cordial greeting for which they are so well known.

As one enters the exhibition hall from the main entrance and glances to the left, the large sign "Okonite"—a reproduction of a famous trade-mark—can be seen by all over the doorway of one of the handsomest booths in the hall. Being trimmed throughout in orange color, the booth, with its easy chairs, presents an inviting appearance. The company makes no particular display of its productions, except sample cards and a huge mass of pure Para gum, from which okonite is made, which are too well known to need any further introduction to the electrical trade. Capt. W. L. Candee, H. Durant Cheever, George T. Manson and Secretary W. H. Hodgins extend a welcome to all.

The U. S. Mineral Wool company of New York shows an exhibit which is well worth going to the exhibition hall to see, and that many appreciate this fact is seen from the large number of people continually gathered about it. A model of a house shows how mineral wool is used about the windows and doors and exposed portions to keep out the cold; this material also possesses absolute fireproof properties. Crude rock wool is seen in its various stages of manufacture, also showing how it is applied to steam pipes, and in numerous places where it is necessary to protect from the atmosphere. Corrugated copper gaskets are also an object of great interest. Secretary Henry H. Franz entertains the visitors with explanations.

The Peck Electrical company of New York makes a display which is of great interest. A model of an electric fire engine made by the Birkett & McElroy company of Brooklyn shows great possibilities. This company has recently been appointed agent for New York city and vicinity of the Helios Electric company of Philadelphia for its arc lamps, and it had one of the latest Helios alternating lamps erected, with pole, fixtures and hood, and also direct current lamps. A large number of the T. H. Brady electrical specialties, manufactured in New Britain, Conn., of which this concern is the agent, are arranged in such manner that a working exhibit is shown of them. The American Carbon company exhibits its various manufacture at this booth.

The Jewel Belting company of Hartford, Conn., has one of the most tastefully arranged booths on the ground floor. On the back wall is a sample of its renowned four-ply Jumbo belt, which was sold to the Washburn-Moen Manufacturing company of Worcester, Mass., which is 79 inches wide and weighs 3,205 pounds. A three-ply 63-inch belt, purchased by the Norwich Electric Light company, and a two-ply 45-inch belt, purchased by the Passaic Lighting company, forms a portion of this company's exhibit, and shows the high grade of belting which this concern manufactures. Treasurer C. E. Newton and General Sales Agent C. L. Foles of Hartford, and the New York manager, C. E. Ainsworth, were kept busy a large share of their time by friends asking for their beautiful souvenir pocketbook.

An enjoyable feature of the week was the reception given to the members of the National Electric Light association and their friends on Thursday night by the Crocker-Wheeler company. A special train carried the party to Ampere, N. J., where the spacious and well-appointed factories of this company are located. Special trains were run on the various railroads and it is estimated that 2,000 people witnessed the celebration. The shops were shown to the visitors in full operation; the grounds were brilliantly illuminated; there was music by the band and a fire drill by the employes, and everybody had a good time, actuated by the spirit of hospitality and good fellowship which was symbolized by a large incandescent lamp-sign, "Welcome." There was a notable attendance of prominent electrical men, to whom a collation was served. The occasion was greatly enjoyed by all present, who were enthusiastic in praise of their generous hosts.

The Clonbrock Steam Boiler company, although located on the annex floor, presents one of the most comprehensive exhibits seen about the exhibition hall, by models of the Climax boiler, which are of great interest to the delegates and visitors interested in steam boilers, because of its peculiar construction and great success attained among the electric light and power stations. Numerous photographs showing different installations are hung about headquarters, while the new catalogue, only a few days from the press, profuse in illustrations, is in great demand. The letters testimonial from some of the most prominent men in the electric lighting field, are especially strong indorsements of the Climax steam generator. John Mason is in charge of the headquarters, while General Manager S. V. Morrin is in attendance. On May 9th an invitation was extended to visit the United Electric Light & Power company's plant and passes were issued to those desiring them. A pretty souvenir showing the boiler in detail was distributed.

The Partrick & Carter company of Philadelphia does not very often make an exhibit, but when it does it is as complete as time and money can produce. Its exhibit as a complete electrical supply house in one of the handsomest booths in the building, and the showing of the advancement of household goods in the electrical line in the many years that this firm has been identified with the business, is of great interest to the throng of spectators continually surrounding the company's headquarters. The company shows complete hotel systems with transmitter annunciators, including the most recent applications. Its telephone system with stations located in various portions of the hall, works successfully and is the cause of endless amusement to the people who talk over the wires. The catalogue and descriptive list is one of the most complete ever gotten out in its line. C. M. Wilkins and E. Ward Wilkins of this company were assisted by T. L. Townsend and F. S. Carter, who presented a note book, which included a celluloid calendar elaborately gotten up in leather, to many applicants.

One of the most attractive exhibits is that made by the Interior Conduit & Insulation company of New York, which occupied a large space on the center floor of the main hall. Entering the hall, the eye of the visitor is immediately attracted to the large electric sign of the company, the decorated pipes of an organ, a printing press in operation and an artistic array of polished brass Lundell fan motors, all of which served to attract large crowds around the exhibit both day and night. A more careful inspection shows that a Lundell motor is directly connected to the printing press, a Lundell organ blowing outfit operates the organ, while the Lundell desk and ceiling fan motors are all busy in disseminating their refreshing breezes. A direct-connected Lundell exhaust fan outfit, Lundell motors and dynamos, direct-connected generating set, dental outfits, etc., all in operation, also attract much attention. The company shows a full line of its iron armored, brass armored and plain interior conduit, as well as the multifarious fittings which go to make that system complete. The underground system of conduits for electric wires is also exhibited.

Immediately upon entering the main door of the exhibition is noticed the space occupied by the Westinghouse Electric Manufacturing company of Pittsburg. There is a beautiful red and gold sign suspended above the exhibit, but even without that it could be easily recognized that this is the place where the Westinghouse people are holding forth, inasmuch as Tesla motors and other Westinghouse apparatus are plentifully in evidence. A. C. Zimmerman of the New York office and M. MacLaren from the Pittsburg factory are in charge of the exhibit. Mr. MacLaren had been especially detailed to look out for the power transmission from the Niagara Falls power circuit. The company has on exhibit a lamp-board in the center of which is seen the Shallenburger electric meter. The case of this meter has been removed, and in this way the actual operation of this

well-known device is plainly demonstrated, and it attracts a great deal of attention. Another interesting feature is an illustration given of the principle of induction, which is demonstrated with an induction coil. The company's exhibit is lighted with the well-known Sawyer-Man incandescent lamp. On the floor stands a 20 horse power Tesla motor, driving a 20 horse power direct-current generator. In addition there were several other Tesla two-phase motors, single-phase motors and a number of converters. C. F. Scott, the electrician of the company, Mr. Allen from the Philadelphia office, and E. H. Heinrichs, the advertising agent of the company, were in attendance during the convention.

The National Underground Cable company, manufacturers of lead covered underground cables for all classes of service, and the National Conduit Manufacturing company, manufacturer of the well-known cement-lined tubes for underground conduits and builders of complete subway systems—the two companies are now consolidated and under one management--find themselves so busy at their factories on large orders for street railway cables, telephone, telegraph and electric light cables, and underground conduits, that it was impossible for them to get their exhibit ready in time for the electrical exposition, and they were with great reluctance compelled to give up the large space which they had engaged in the exposition hall. Although it could hardly be expected that these two companies would spend the necessary time to make up their large exhibit while their factories at Harrison, N. J., and Hastings-on-Hudson, N. Y., are compelled to run night and day with double forces of men to keep up with orders, still it is to be regretted that the delegates to the convention and the visitors to the exposition will be denied the pleasure of seeing a complete underground system, including underground cables, conduits, manholes, lampposts with all the latest apparatus and appliances, and a street railway system in miniature in operation. Although the National companies are not exhibiting, they are well represented at the convention and exposition by E. S. Perot, James P. McQuaide, C. Gallagher, E. J. Fenlon, George J. Jackson, T. F. O'Connor, E. S. Reid, D. P. Regan, H. F. Tate, F. S. V. Sias, and W. H. Lewis, who extend a hearty welcome to their many friends from all over the country. The main offices of the company in the Times building, New York city, during the exposition has hospitably opened doors.

The exhibit of the Electric Storage Battery company is attracting its full share of attention. A battery of 128 chloride accumulators in glass jars erected upon a handsome stand is operated in conjunction with the Edison system, being charged through a motor booster. The battery has a capacity of 500 16 candle power lamps. In connection with the battery there is a complete switchboard of white marble enclosed in an oak cabinet. Upon the board are mounted Weston ammeters and voltmeters, charge and discharge switches, end cell regulating switches, automatic cut-outs, etc. The installation is complete in every detail. A portion of the exhibit which attracts a great deal of attention is a chloride accumulator of the central station type, the element consisting of 29 plates 30 inches high and 15 inches wide. These are suspended in a highly finished lead lined oak tank. The cell is similar to that which is now being installed in several central stations, for which is claimed a capacity of 4,260 ampere hours at 426 amperes discharge, or of 3,000 ampere hours at 1,000 amperes discharge. In size and capacity the cell is a revelation to visitors who have not followed up the developments in storage batteries. The company's exhibit also includes a 21 foot electric launch and an electric carriage, both equipped with chloride accumulators. The carriage is always the center of an interested throng. Portable batteries of chloride accumulators are shown operating fans and table lamps. The exhibit is in charge of Charles Blizard, assisted by Messrs. R. W. Rundle and W. O. Knudsen. The models of the Niagara power plant and of the Erie canal are operated during portions of the day from cased chloride accumulators stored with Niagara energy. The current for firing the cannons located at different cities throughout the country announcing the opening of the exposition was also drawn from chloride accumulators.

The General Electric company's exhibit at the Exposition is rather a pervading presence than a specific exhibit of its manufactures. Incandescent lamps, arc lamps, generators and motors in their vast variety of ramifications, invented or developed by such men as Edison, Thomson, Van Depoele, Sprague and many others form the staple of the exhibition, and thus the General Electric company finds most comprehensive representation. The space occupied by the company is at the base of the south wall of the hall. It is enclosed by a pilastered cornice studded on the outside with a line of special six candle power miniature yellow lamps broken at the top of each pillar by a group of four violet lamps of the same candle power, and on the inside with 240 volt 16 candle power frosted lamps. Above the space against the wall is a large monogram, with the initials of the company set in different colored miniature lamps. The right of the space is occupied by a stand supporting a number of swivel frames containing photographs of some of the important work done by the General Electric company. To the left of the space stands an ornamental upright carrying arc lamps of the long burning, constant potential, direct and alternating incandescent and power circuit types. On the tables are a number of samples of the new line of measuring instruments for alternating circuits, some of the new alternating current fan motors, and two samples of the new type H transformers. The space is enclosed with a unique railing formed of railway feeder cable supported by insulated suspension and

turnbuckles. The miniature lamp department has an exhibit of its own placed in a small room, left of the main space. The principal feature of this is a display board, on which is mounted a sample of every kind of incandescent lamp outside the miniature category manufactured by the company. On a stand in the center of the room are two boards, one carrying a variety of samples of candelabra miniature and decorative lamps, the other samples of the battery lamps. In this case, the smallest incandescent lamp manufactured is shown—about the size of a small pea. Several of the ornamental illuminated designs gotten up by this department are used to embellish the room. Attached to the ceiling is a beautiful "sun;" the wall is adorned with a four-leaved clover and horseshoe and a patriotic device with the eagle surmounting the United States shield, on which the colors are shown in small lamps. The two other designs are entitled "Mischief Brewing" and "Homeward Bound." The first represents a little witch bending over a seething pot beneath which glistens a red fire, while fays and sprites appear and disappear and a grewsome green-eyed cat glowers from beneath the witch's pointed hat. "Homeward Bound" is a full-rigged ship, tossing and pitching on her way through the moonlit waters, her port and starboard lights showing as she appears wafted toward the spectator. The company is represented by S. D. Greene, J. R. Lovejoy, W. L. R. Emmet, J. Kirkland, H. C. Wirt, W. Felton, J. M. Andrews, of the Schenectady office; Charles T. Hughes, T. Beran, C. Gundaker, C. G. Davenport, George D. B. Greene and others from the New York office; C. B. Davis, F. M. Kimball, Haley, Ives and Bush of the Boston office; H. J. Buddy of the Philadelphia office; W. F. Hayes of Cincinnati office; A. E. Giles of the Atlanta office, and A. D. Page, M. K Eyre and McAllister of the lamp works at Harrison.

The exhibit of the Edison Electric Illuminating company of New York, is situated directly under the overhanging extension of the first gallery along the south side of the main hall, the space occupied being 84 feet long by 10 feet wide. As the visitor enters the main hall from the stairway, he will first see a pictured representation of the great operating room of the Duane street central station, in front of which are shown actual sections of the electrical controlling apparatus constructed on the Van Vleck edgewise system, similar to that in use at the Duane and Twelfth street stations; the apparatus in the center consists of a dynamo controlling section complete with edgewise amperemeters for regulating two large-sized multipolar dynamos; while at the side, near the column, is shown the feeder controlling apparatus, having a capacity sufficient to control both poles of four feeders, each of 1,000 amperes capacity. Current for this exhibit is supplied to this feeder switchboard from the Edison street mains and from a storage battery to be seen behind the exhibit, similar to the batteries in use in the Edison stations. From this switchboard the current passes through an Edison feeder tube, such as is used in the city streets, after which it passes into a feeder box, thence to a distributing box and thence through a street main to a service-end box, such as is placed on a consumer's premises. Alongside the feeder box is one of the new controllable junction boxes, as developed by the company, by which a tie feeder between two stations can be divided from the station into individual service feeders. From the service-end box current is carried through an Edison chemical meter, such as is usually placed in a customer's premises, and also through a Thomson wattmeter, after which it is distributed for its varied applications in lighting (incandescent and arc), power, cooking, heating, etc. Two arc light posts, constructed on the Edison-Bowker system of street lighting and similar to those in use on Fifth avenue, are placed at the front of the exhibit. In the center of the main exhibit may be seen an illuminated representation of the upper field frame of one of the huge 800 kilowatt dynamos now in use at the Duane street station, the largest lighting generators in the world, capable of supplying current for more than 12,000 16 candle power lamps. In the next space beyond is shown an interesting collection of various electrical surgical and dental apparatus, together with electric fans and an electrically driven sewing machine. Electric cooking is also shown in practical operation, with electric ironing and electric heating; an "electrotherm" for bed-warming, poulticing, etc., will be of interest, as well as many other applications. The power exhibit at the extreme end includes a modern printing press run by electricity, without belt or shafting. Directly behind the large dynamo field frame is an interesting collection of photographs of the principal stations and other equipment of the company, which has now six stations, supplying more than 6,000 customers, with over 300,000 incandescent and 3,700 arc lamps, and about 15,000 horse power for power and miscellaneous purposes, forming the largest installation of any electric supply company in the world. In addition to this exhibit in the main hall there can be seen an electrical dark-room, in which is a joint exhibit of electric lamps manufactured by the General Electric company and supplied by the Edison company. This room illustrates various methods of lighting, including the latest plans for using reflected light from concealed lamps. Electric signs and advertising specialties are also here exhibited.

An advertising expert thus describes the Safety company's exhibit. "I was passing the exhibit of the Safety Insulated Wire & Cable company, when just in front of me there flashed out a sentence in red and black letters on a white ground, the whole framed in quarter oak and standing on an oaken easel. A moment before the picture was a blank, but now I was challenged to read it; had to stop, and before I had finished there was another little picture on the side wall which told a story and disappeared. Then my eye caught a picture which a moment before had been invisible, showing two of the cruisers of our navy equipped, as the legend underneath informed me, with Safety wire. By this time I began to have some distinct impressions of the value of this di play from the advertising standpoint, and I began to study it. A gentleman who had charge of an electric l ght plant in a suburb of the city sauntered by. But stop he must, for a large electric sign had begun to exert an influence over him; a fac simile of the head of a Western Union telegraph blank appeared, and then he, individually, was addressed as he saw the words flash out, 'Mr. and Mrs. Delegate.' then one word after another, this message was written in rough handwriting, but sufficiently legible: 'You—are—cordially—invited—to—visit—our—factory. Plant—is—extensive—and—process—interesting. Safety Insulated Wire & Cable Co., 225 to 239 West Twenty-eighth street, New York city.' Mr. Delegate winked approvingly at a companion and watched every other picture in the entire gallery appear and disappear, and with each one he received a distinct impression 10 times as forcible as if they had all been shown together, perfectly constant and stationary. I watched and watched and became convinced from what I saw of the effect of this constantly changing scene, that that was the most effective piece of advertising in the entire show. Surely it was an important fact, and one well worth impressing all by itself, that the wire and cable used by the managers in the equipment of the electrical show was Safety wire. To secure attention to this fact, while it was in evidence, everything else except the central picture was shut off. But the ingenious method of arranging these signs amazed me. In front of the entire exhibit, acting at once as a railing and as a sample board, was displayed very handsomely a full line of samples of wire and cable; pieces a foot long were handsomely attached to an oaken slab and then a cross-section of each cable was made and deftly inlaid in the oak so that each sample was fully displayed in its outer and inner character. This in itself was interesting, but when to this fact was added another, that many of these were numbered and were referred to in the electric picture signs in front, the interest was doubled. Here, for instance, was No. 1, which, a sign informed me, was the style selected by a Philadelphia company in making a $400,000 contract for underground wire; the la gest contract ever placed for insulated wire and cable. Some 160 miles had been laid by this company in Boston underground, and No. 3 was the cable used. Eight hundred miles in New York subways, said another sign. All these were facts which were quickly and fully stamped on my mind and I shall not soon forget them. Another sign showed me the steamer St. Paul stranded on the Jersey coast, and I could see the wire stretching from her to the shore, and which an electric sign said was Safety wire; it stood the test of those stormy days on the coast and the shifting of the steamer without once parting. The central sign in this fine display was the firm name surrounded by the three trade-marks of the three different wires. This name was constantly changing color by reason of the interchange behind it of red, white and blue lights, a kaleidoscopic effect which was certainly very pleasing."

## Milwaukee Street Railway Trouble.

[Special correspondence WESTERN ELECTRICIAN.]

MILWAUKEE, WIS., May 8.—During the whole of the present week about 1,000 employes of the Milwaukee Street Railway company, mostly motormen and conductors, have been on a strike. President Mahon of the Amalgamated Association of Street Railway Employes is in charge of the union forces. The demands of the union were as follows:

Inc ease in the pay of motormen and conductors from 19 cents to 20 cents an hour; that the running time of cars be divided equally between the day men and the night men, and that the preference in respect to runs be given to the men longest in the service of the company; that "extra" men, in regard to their work and the receiving of regular runs, shall rank according to their term of service; that all motormen and conductors working two hours or less a day shall be paid at the rate of 25 cents an hour; that the time of all men shall commence from the time that they report according to order, and that when they are detailed to run the sweepers or the salt cars they shall be paid a full day's wages for such work; that in all departments of the repair shops 10 hours shall constitute a day's work, the wages of such employes to remain as before, with time and half for over-time; that in all cases of grievances or complaints the committees of the men shall be received and the matters at issue discussed; that the employes shall be entitled to free transportation over all the lines owned or operated by the company; that the employes shall have the right to purchase uniforms where they can get them most cheaply, provided they get the regulation uniforms called for by the company; and that all differences which may arise shall be submitted to an arbitration board.

President Flint of the Milwaukee union said:

Many of our demands are in accord with wishes that the officers of the company have often expressed but which they have never carried into effect. The putting on of extra men is a case in point. The company claims that it gives preference to the men longest in the service, but as a matter of fact it does nothing of the kind. With respect to the giving out of permanent runs, we claim that it is only just that preference should be given to the oldest employes. The demand that men who work two hours or less be paid at at the rate of 25 cents an hour is a new idea, but we deem it a very proper one. We shall insist upon the demand that a man's time be counted from the moment he reports for duty. The men report twice a day

and at present they must report 10 minutes in advance of the time that their car leaves, or they lose the trip. This makes 20 minutes that the men are on duty without being paid for it. Again, gentlemen are always taken off their cars to run sweepers or salt cars, which perhaps they operate for only two or three hours while "extra" men take their places on the cars. They are obliged to give up a full day's work to run a sweeper or a salt car, but for this irregular service they are paid for only the actual time that they put in, and so we ask that they be paid a day's wages for operating a sweeper or a salt car.

We want the company formally to recognize the union. While we do not desire to dictate to the company whom it shall employ, still we want our committees, when they go to the office, recognized as the representatives of our organization. So far as the purchase of uniforms is concerned, we are now allowed the choice of three tailors, whose prices range from $16.50 to $22. The power house employes work from 11 to 13 hours a day, and we want a reform in that respect.

The union's representatives and the directors of the company, including Messrs. Payne and Pfister of this city and Messrs. Wetmore and Spofford of New York, held a conference last Sunday, at which the company refused the demand for higher wages as well as that for arbitration, ignored the demand for the recognition of the union and intimated that it was not necessary, under the circumstances, to discuss the other demands at that time. Another conference between the men and the company was set for Monday forenoon, but during Sunday the men learned that the company had imported negro cooks from Chicago and that it was taking steps to engage new men. Fearing a lockout in case they waited until Monday forenoon, the men, after trying in vain to arrange an immediate conference with the company, voted to strike.

Monday morning the street railway service of the city, for the very first time in its history, was tied up. Only a very few cars – not more than 20 – were running, whereas the regular number is 153. The company continued to import men from Chicago, St. Paul, Minneapolis, Indianapolis and other points, and on Wednesday there was an increased number of cars in operation, while yesterday the number had reached a little over a hundred. The motormen, in most cases, were experienced men from other cities.

During the week excitement grew and there were the usual strike disturbances. Stones and eggs were thrown at cars, crowds gathered and jeered, switches were turned or blocked, large stones were placed upon the tracks, and Payne and his associates were hanged in effigy. The strikers themselves, it should be stated in positive terms, behaved in a very orderly manner.

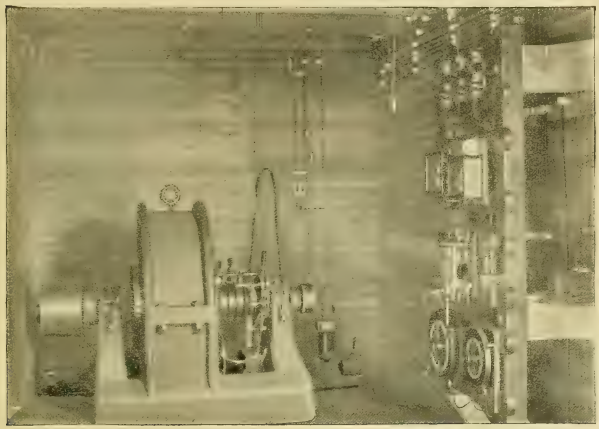
The Common Council held a special meeting during the week to attempt mediation between the strikers and the company. A committee consisting of five aldermen, five members of the Merchants' and Manufacturers' association, and five strikers was appointed to confer with the company regarding a settlement. The company refused to treat with the union men, whereupon the rest of the committee first heard the company's side of the matter and then the strikers' side of it. Finally, yesterday afternoon, a conference was held between the aldermen and business men, a new committee of strikers and the directors of the company. President Flint of the union, to whom the company specially objected, did not attend the conference.

The attempt at mediation resulted in failure. The company stated in writing that it would not change its decision regarding the demands of the men and that it would not discharge any of the men who had taken the places of strikers, but that it would fill such places as remained vacant with the old men who, however, must apply for reinstatement as individuals not as members of the union.

The mediation committee reported to the Common Council that its mission had not succeeded because of the refusal of the company to discharge the new employes and to reinstate the strikers in a body, and because of the refusal of the strikers to return to work unless the whole of them were reinstated.

The council thanked the committee for its services and then discharged it. Alderman Okerstrom introduced a resolution, which was adopted, instructing the city attorney to give an opinion as to the authority of the Common Council to revoke street railway franchises, and upon what grounds and by what means the franchises could be revoked. City Attorney Hamilton, questioned on this point, stated that the Common Council had no power to revoke franchises which it had granted unless the power to revoke was expressly reserved in the franchises. There is no such reservation in the franchises.

There has been introduced in the Common Council a resolution providing for the purchase or acquisition by condemnation of the street railway and lighting systems. Another resolution seeks to condemn the street railway plant and tracks. The idea of both resolutions is to have the city operate the street railway.



PORTABLE ELECTRIC MINING EQUIPMENT. GENERATOR AND SWITCHBOARD INSIDE OF CAR.

## Portable Electric Mining Equipment.

To facilitate the introduction of electric mining machinery and to enable the operator to judge from actual observation of the merits of the system as compared with pick mining, the General Electric company has devised a complete and compact portable power plant, susceptible of installation near the mine mouth. It includes all the necessary electrical apparatus and the operator is called upon to furnish nothing more than the water and fuel.

The generating plant occupies the interior of a box car 40 feet eight inches long, eight feet wide and about nine feet high, and consists of a specially designed water-tube boiler of a capacity of 40 horse power at 100 pounds pressure, furnishing steam to a high speed automatic engine running at 300 revolutions and exhausting into the boiler flue.

The generator is a three-phase machine of 75 kilowatt capacity, wound for 550 volts and running at 900 revolutions. It is belt driven from the engine. A small bi-polar generator serves as an exciter. To the right of the generator is a skeleton switchboard, equipped with the necessary switches, circuit-al and measuring instrument. The coal cutter which forms a part of the plant is the first known adaptation of the multiphase motor to the coal-cutting machine. This motor is iron-clad and is completely enclosed and protected from moisture and injury. It has neither commutator nor brushes and no moving wires. It stops operation as soon as it has reached the limit of its power, and thus is not exposed to accident in case of overload. Furthermore, it is sparkless. The cutter itself is a chain machine making a cut three feet wide, six feet deep and 4½ inches high in about 3½ minutes. It withdraws in about 10 seconds. The capacity of the motor is 20 horse power, but the consumption of power under ordinary conditions is between six and seven horse power.

The portable electrical coal-cutting plant has recently been operating in the mines of the Peerless Coal & Coke company at Vivian, W. Va., where the record for machine coal cutting has been established. The amount of cutting showed the remarkable average of 7 6 runs or cuts per hour. Taking the depth of cut at 5½ feet, the width 36 inches and the thickness of the coal five feet, for a period of two weeks, the average weight of coal undercut per hour was not less than 23 tons. At the mines of the Sterling Mining company, Cannelton, Pa., a contract for several of these coal cutters was given to the General Electric company after exhaustive examination of the multiphase system in operation.

MANHATTAN ENCLOSED ARC LAMP

## Manhattan Enclosed Arc Lamp.

The Manhattan lamp, herewith illustrated, has been commercially on the market for about one year and a half, and has quietly and gradually built up the reputation of enclosed arc lamps to such a degree that the principle is now acknowledged to be correct. Since starting the Manhattan General Construction company of New York has placed in service about 7,000 Manhattan lamps, and the lamp has been adopted by 100 direct current central stations.

One advantage of this lamp, outside of its economy, is the possibility of drawing an arc at 80 volts, making it possible to burn lamps singly on incandescent circuits instead of two in series, as was necessary with open-air arc lamps. The advantage of each lamp being an independent unit will do much toward extending the use of incandescent arc lamps in all kinds of service. The arc being enclosed within two practically air-tight globes, prevents the throwing out of sparks and carbon dust, and makes the lamp particularly desirable from an underwriters' standpoint. Perhaps the most attractive feature of the enclosed arc lamp is the diffusion of light obtained by the use of the double opalescent globes. The inner globe diffuses the light on the outer globe and removes absolutely all shadow from the outer globe, as well as beneath and above the lamp, and makes a space lighted by the Manhattan lamps perfectly uniform, and the long arc eliminates all the yellow rays and produces an effect

nearer to true daylight than any artificial light that has yet been offered.

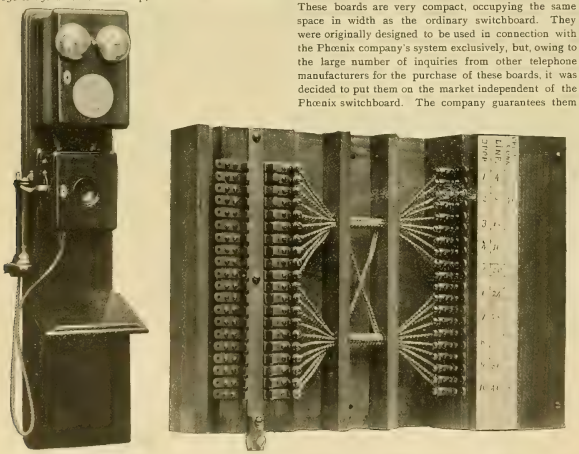
The enclosed arc at once necessitated an entire new style of mechanism. The mechanism of the Manhattan lamp has done away with all clock-work, carbon rods, dash-pots and the like, and is nothing but a solenoid with an armature and simple ring clutch. The carbon feeds direct without the intervention of a carbon rod, which, in addition to overcoming the difficulties incident to a carbon rod, makes possible a very short lamp. The Manhattan standard lamp, using 12 inch upper and five inch lower carbon, is only 37 inches long, while the junior type of lamp, using 12 inch upper and five inch lower carbon, is only 23 inches long over all.

After burning for 150 hours there is sufficient left of the upper carbon to use for a lower carbon for the next run, so that on the basis of 10 hours per day the cost of carbons for one year with the Manhattan lamp (at $25 per 1,000 12 inch carbons) is said not to exceed 50 cents per lamp per year, whereas in commercial work where the average burning of lamps is less than four hours per day, the lamp will only require for 300 days' service about eight carbons per year, or 16 cents per lamp per year for carbons. With the ordinary open air arc lamps the cost of carbons on 10 hour service is over $10 per lamp per year, so that on the 10-hour basis there is shown a saving of $9.50 in carbons alone, and on the four-hour basis a saving of over $5 per lamp per year, as there is considerable waste in the necessity of always having lamps trimmed and not allowing them to run until the carbons are fully consumed. The saving in labor is said to be about two-thirds, so that the saving on commercial and street lighting service might be given at from $10 to $15 per lamp per year.

In relation to the efficiency of the enclosed arc lamp, the company states that with a Manhattan lamp on a 110 volt circuit there is a permanent resistance taken up from 28 to 30 volts, which at five amperes makes 140 to 150 watts consumed in the resistance. In open air arcs there is a permanent resistance of 13 to 15 volts in each of the pair of lamps running at 10 amperes, or there is consumed in the resistance from 260 to 300 watts for the pair, or 130 to 150 watts to each lamp, so that it will be seen that the efficiency of enclosed and open-air arc lamps is practically the same.

One of the main features of the Manhattan lamp is the use of double globes, both of which are practically tight. The outer globe being entirely enclosed, of course, acts as a thorough protection against weather, but, in addition, the outer globe acts as a storage chamber for the inner globe or chamber of high rarefaction, and makes the admission of air containing oxygen into the inner globe and to the carbons very slow.

The city of Marshalltown, Ia., will purchase two arc dynamos of 75 lights capacity each and 20 additional lamps

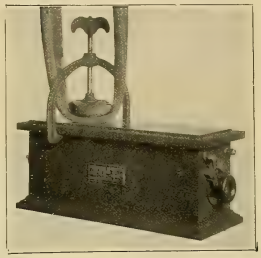


FIGS. 1 AND 2. PHŒNIX TELEPHONE AND MANUFACTURING COMPANY'S APPARATUS.

## Phœnix Telephone & Manufacturing Company's Apparatus.

In the accompanying illustration, Fig. 1, is shown the "No. 2" exchange telephone manufactured by the Phœnix Telephone & Manufacturing company of 40-42 West Quincy street, Chicago. This is confidently put forth as a thoroughly high-grade instrument, representing the most careful workmanship on the best material. The ungranulated type of transmitter is used, as it is claimed to give the most powerful tone for the least current, and as it is free from infringing on existing patents.

In Fig. 2 is shown a section of the Phœnix cross connection board. The regular-sized board has 100 terminals and is wired up complete ready for cable and switchboard connections. The fuse holders are arranged so that the fuse can be easily seen and quickly replaced after being burned out by lightning. The cover of the cable or distributing box is so arranged that a perfect record can be kept of the lines and cross connections. These boards are very compact, occupying the same space in width as the ordinary switchboard. They were originally designed to be used in connection with the Phœnix company's system exclusively, but, owing to the large number of inquiries from other telephone manufacturers for the purchase of these boards, it was decided to put them on the market independent of the Phœnix switchboard. The company guarantees them to give absolute protection against lightning and other heavy electric currents.



ELECTRIC VULCANIZER.

## Electric Vulcanizer.

The electric vulcanizer shown in the illustrations has been demonstrated to be a simple and most reliable device. To properly combine two pieces of rubber into one mass, it is necessary to subject them to an absolutely uniform, definite temperature for a stated period. This is accomplished by the electric vulcanizer. Steam heat, or heat from a gas flame requires constant attention, and the electric practically none. The danger of steam or gas explosion and the attendant fire risks are entirely avoided. The perfect regularity which is obtained with the electric, guarantees a good job with but little skill or experience on the part of the operator. There is no danger of burning a tire with the electric vulcanizer, when its operation is once understood. The machine may be set up on any substantial table or work-bench, and a space of two by three feet is ample. The tire is clamped to the plate of the vulcanizer under a pressure of about 15 pounds, and the illustration shows the method by which this is usually accomplished. Several bicycle tires can be repaired at one time. The temperature of the plate is controlled by a rheostat or switchboard on the end of the machine. The heat is applied by turning the switch to the right, and each successive turn from left to right increases the amount of heat applied to the plate. The proper temperature can be determined accurately by curing a piece of uncured rubber, allowing it to remain on the vulcanizer about 30 minutes. By this method the correct position of the switch can be determined to give the exact temperature required for all subsequent operations.

This device was first put on the market in August 1895, and several hundred of them put into active use, and in every case they met with the highest commendation, being adopted and recommended in an unqualified manner by some of the best manufacturers of tires in the United States. This year they are made in two sizes; the larger, type B, with two plates, suitable for large repair shops, and the smaller, type A, with one plate, suitable for the average repair shop. The American Electric Heating, corporation, Sears building, Boston, handles this vulcanizer.

## Street Railway Situation in Boston.

[From the Boston correspondent of the WESTERN ELECTRICIAN.]

There is an all-absorbing interest in this city at the present time in the street railway situation. The subway, or a portion of it at any rate, is fast nearing completion, and by the 1st of January, 1897, it is expected that some of the cars of the West End company will be running underground. It is getting to be quite the popular thing to visit the completed sections of the tunnel. Members of the Legislature and the governor and his council went through the "hole in the ground" the other day, and the commissioners also entertained the City Council of Boston in a pilgrimage into the bowels of historic and sacred Boston Common recently. Matinee parties composed of the regular "swells" of the city are not of infrequent occurrence, and the stranger in the city would not think of leaving without first having seen the great work in progress.

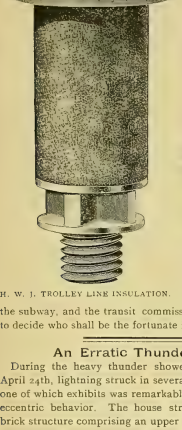
But the financiers look at the subway from their own point of view. They are considering the manner in which it shall be utilized and by whom it shall be controlled when it is finished. J. Pierpont Morgan of New York, with, it is presumed, unlimited capital behind him, has appeared on the field as the purchaser of the Meigs elevated railroad charter, which is under the title of the Boston Elevated Railroad company, and it is claimed that if the present plans do not miscarry Boston and vicinity will have an elevated railroad system equal in extent and magnitude of interests involved only by the Manhattan system of New York. The elevated road is the main point aimed at, and as things have been decided up to date, it is sure to come. A secondary feature is to secure the subway for this elevated road. It has not been done yet, but the gentlemen interested feel quite certain that they will be successful. The third point—and this is the most sensational feature of the whole scheme—is the ultimate absorption of the West End street railway by the new company, notwithstanding that the promoters are now apparently only interested in having the Meigs charter fixed up so that it will be possible to construct and operate the elevated road under its provisions.

Eminent counsel, of whom ex-Governor William E. Russell of Massachusetts was one, appeared before Acting Governor Walcott the other day with the request that in a special message he call the attention of the Legislature to the desires of the capitalists. The accompanying petition provided merely for amendments to the Meigs charter to make it of value to men with money to invest. The charter granted to the Meigs company provides for a capital stock of $10,000,000, which may, if it is deemed advisable, be increased to $20,000,000, to allow for the extension of the system according to the plans arranged under the provisions of the charter. The document allows the corporation known as the Boston Elevated Railroad company to construct and put in operation the Meigs system or any other system of ele

vated railroads that it desires, except that in use in New York known as the Manhattan system. It appears that the Morgan syndicate wishes to adopt perhaps not the Manhattan system, but one so closely like it that a court of law might be required to determine the difference; it cannot see its way clear to use the patents granted to Mr. Meigs, and it seems to think that there is no other system available for its purpose. Therefore, the gentlemen interested desire to have certain amendments to this charter passed by the Legislature which will permit of adopting something similar to the plans especially prohibited.

Now the subway is absolutely essential to the West End railway for the running of cars in the center of the city, and the Morgan syndicate wants the subway. As the subway is necessary to both the West End and the Boston Elevated, that is where the conflict is coming. The present management of the West End, it is stated, being opposed to any sort of an elevated structure for traffic in the city, it naturally follows that these gentlemen do not want the cars of such a system running through the subway in opposition to the electrics of the street railway, making for the elevated a connecting link between the tracks of the north and south ends of the city.

The contest will probably be begun this spring. It will be made before the Legislature, if moves are made at this session to secure the desired amendments; but it will be felt particularly in the struggle to get control of the subway, and the transit commission has the power to decide who shall be the fortunate in that one respect.



H. W. J. TROLLEY LINE INSULATION.

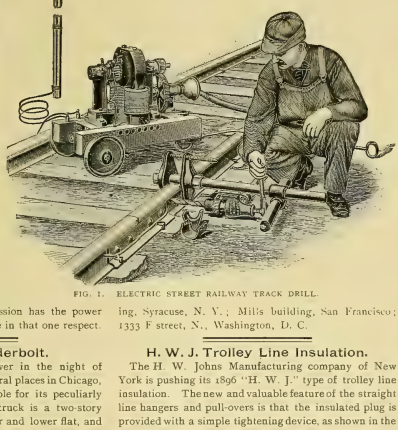


FIG. 1. ELECTRIC STREET RAILWAY TRACK DRILL.

## An Erratic Thunderbolt.

During the heavy thunder shower in the night of April 24th, lightning struck in several places in Chicago, one of which exhibits was remarkable for its peculiarly eccentric behavior. The house struck is a two-story brick structure comprising an upper and lower flat, and stands upon the corner of two streets on the north side of the city.

The bolt descended upon the northeast corner of the structure, and seems to have divided into several smaller bolts. Marks on the outside of the building (which is separated from contact with other dwellings on all sides) show plainly that a portion of the discharge descended to earth along the outer wall, on the east. The transom over the front door, which faces north, was shattered. A third portion of the bolt made a hole through the center of a brick, tearing out a large portion of the material, and then escaping downward along the wet wall. Another portion went down inside the wall, tearing off the plaster in a bed-room, and casting a foot square or so of broken plaster on two young men in bed. From this point it took a southwesterly direction through a lath-and-plaster partition into the pantry, knocking off more plaster and breaking all the dishes on the shelves and setting the paper on fire. The two bell wires to the front door were in its way, so it melted them and jumped down some six feet to the floor, ran along the kitchen floor under the stove, tore up a board, and finally reached the waste pipe of the sink, nibbled a small bite out of that, and disappeared to the ground.

In front of the stove there is a charred spot two inches in diameter, which the housekeeper says was not there before, and that there was nothing there to burn but the floor.

The stone door-step, at the middle of the house on the east side, has a mark much like that of a firecracker burn, and a notch as large as a small pea is cut out.

A representative of the WESTERN ELECTRICIAN went carefully over the ground with the owner of the building, who for obvious reasons did not want the locality known. He says he has no lightning rods, and doesn't want any.

## Reorganization of the Sawyer-Man Electric Company.

The board of directors of the Sawyer-Man Electric company announced on May 4th that the company have been reorganized and that the manufacture of the Sawyer-Man incandescent lamp had been resumed. This, no doubt, will be welcome news to every user of incandescent lamps in this country, for the reason that for economy, long life and efficiency the Sawyer-Man incandescent lamp has always maintained an exceedingly high standard. The company has opened offices at 120 Broadway, New York; Westinghouse building, Pittsburg; Exchange building, Boston; Erie County Bank building, Buffalo; New York Life building, Chicago; Girard building, Philadelphia; 102 South Tenth street, Tacoma Wash.; American Central building, St. Louis; 36-38 College street, Charlotte, N. C.; Bastable building, Syracuse, N. Y.; Mills building, San Francisco; 1333 F street, N., Washington, D. C.

## H. W. J. Trolley Line Insulation.

The H. W. Johns Manufacturing company of New York is pushing its 1896 "H. W. J." type of trolley line insulation. The new and valuable feature of the straight line hangers and pull-overs is that the insulated plug is provided with a simple tightening device, as shown in the cut. Construction men who have found it impossible to remove the caps of this general type of hanger will appreciate this device. The ear can be easily attached or detached without removing the cap. Another feature is that the design of the hanger admits of a large bearing surface for the plug, together with an unusual length of insulation surface. The insulation is the standard composition manufactured by this company. The Chicago office of the company is at 240-242 Randolph street.

## Electric Street Railway Track Drill.

Those engaged in electric street railway work will be interested in the electric street railway drill illustrated in Fig. 1. This appliance has been recently designed by the Stow Manufacturing company of Binghamton, N. Y. (the inventor and manufacturer of the Stow flexible shaft), and is a modification of its well-known combination of Stow flexible shaft and electric motor. The latter has been on the market for several years, and the manufacturer unhesitatingly recommends it as a device superior to any for portable drilling, tapping, reaming, emery grinding, etc., about the shop or yard. Its range is limited only by the length of connecting wire used. For track drilling, however, the Standard drill press was not compact enough, and the gears, being uncovered, were exposed to the grit and dirt of the road. The company has entirely overcome this in its new track and corner drill, shown in Fig. 2. The gears are covered. It is very simple, durable and easily handled, and will drill holes up to one inch in diameter.

The practicability of the complete combination can be readily seen. Easily handled, it can be placed on a car and transported to any desired point on the road, connection with the trolley wire can be made in a moment and the work done in a quarter of the time required by the old method. Descriptive catalogue, price-list and all desired information will be furnished on application.

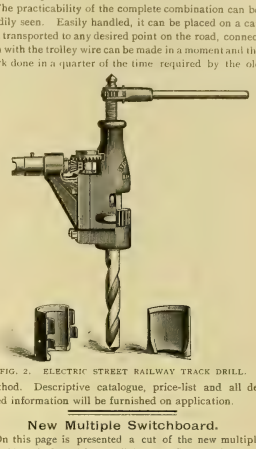


FIG. 2. ELECTRIC STREET RAILWAY TRACK DRILL.

## New Multiple Switchboard.

On this page is presented a cut of the new multiple switchboard of the Western Telephone Construction company of Chicago. This switchboard is a new arrangement of the company's regular No. 1 type, which has proven its superiority in practice. The idea of this switchboard is not to multiple the jacks, as it was learned that the multiple-jack system would become top-heavy, cumbersome and self-interfering after it increased above 1,000 telephones. The great number of interconnections of the Bell multiple system was found to be so troublesome that new methods were determined upon, the company says. The cut shows a 300 section of a 2,000 equipment. These sections fit into each other so that they appear as one section. This switchboard is the only one in use which does not require remodeling when considerable extension is made upon 1,000 or more telephones at great expense. In this switchboard the claim is made for the highest degree of efficiency in modern central office large exchange work. Any operator can connect with any line in the system with fewer movements than the most rapid "express" type of the Bell system, it is asserted, and those who have seen it wonder why "some one has not found this out before."

NEW MULTIPLE SWITCHBOARD.

## Street Railway Management in European Cities.

Henry C. Payne, vice-president of the Milwaukee Electric Railway & Lighting company, has returned from Europe, where he has spent nearly half a year for the benefit of his health, which is now fully restored. Mr. Payne states that in Europe rapid transit is not known yet, for in none of the cities which he visited have they done away with mule and horse power for street

cars. In Europe the amount of fare to be paid is regulated by the distance to be traveled. For instance, one rides a mile for two cents, two miles for four cents, three miles for six cents, four miles for eight cents and five miles for 10 cents. This system, Mr. Payne says, compels the workingmen to live down-town, thus producing a sort of of congested population, of this kind, in the central part of the city. In Munich the cars now in use are similar to those which were in vogue here before mule power was discarded. The use of electricity for traction purposes is not general in Europe, but in some cases electric cars were in use in the suburbs. The wages of street car conductors in Europe range from $1.25 in London down to 40 and 50 cents a day in Naples.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

The Menominee River Telephone company of Marinette, Wis., and Menominee, Mich., intends to put in a system with 600 instruments, having secured that many subscribers.

Dr. E. S. Muir and Dr. J. A. Slocumb of Plainview, Minn., have bought materials for an extension of their telephone line from Plainview to Elba, via Beaver, about 20 miles.

The automatic telephone system at Rochester, Minn.. will be extended to Winona, Stewartville and Oronoco early this spring.

D. G. Nilson of Sioux City, Ia., is putting in 30 automatic telephones at Elk Point, S. D., the invention of W. A. Houts of Parker, S. D.

The Northwestern Telephone Exchange company will extend its long-distance system from Winona, Minn., to Rochester. The right of way is now being secured.

The Western Union Telephone company, a new concern, has arranged to extend its lines south from Algona, Ia., and connect with Irvington, Luverne, St. Joe, Livermore, Hardey, Renivice, Arnold, Bode and Humboldt.

The Northwestern Telephone Exchange company will expend $5,000 to $6,000 in improvements to its Stillwater, Minn., system.

The Forman Telephone company of Forman, N. D., has declared a four per cent. dividend. The extension to Sheldon and Enderlin, via Buttzville, will be begun in the early spring.

The Blue Earth Valley Telephone company of Winnebago City, Minn., will extend its line from Wells, Minn., to Mankato, via Mapleton.

## Branch Telephone Exchange Proves Popular in Milwaukee.

The success of the Wisconsin Telephone company's branch exchange on the South Side has been so great that the company has decided to establish a similar branch on the West Side, in some convenient locality. "By the branch exchange system," says General Manager McLeod, "the subscribers get perfect telephone service more cheaply than they would get it if they were directly connected with the main office. While subscribers get as prompt service as ever between their section and any other part of the city, the branch system reduces the distance and correspondingly reduces the expense and the rates "

## Street Railway Extension at Evanston.

The city council of Evanston, a Chicago suburb, granted a franchise to the Evanston Electric Railway company on April 24th, under which the company agrees to operate a double-track street railway along Sherman avenue from the south line of Emerson street to Central street, and thence upon Central street to Bennett avenue. The company agrees to pay for one-half the lights on its route An the attempt was made to impose a three per cent tax on the road after 1900 The rate of fare is to be five cents between any points in Evanston with no additional charge up to Wilson avenue in Chicago that being the northern terminus of the proposed Northwestern elevated railroad A liberal transfer system is also incorporated. The company agrees to pave 16 feet, eight on each side from the center of its tracks, on the streets that it will occupy. It is provided that the tracks shall be laid within one year. Within 30 days of the passage of the ordinance the company is required to execute a bond to the city of Evanston for the sum of $50,000

At a [illegible] election the village of Vicksburg, Mich., [illegible] $12,000 for water works, and the [illegible] $3[illegible] [illegible] and power plant

## CORRESPONDENCE.

### New York Notes.

NEW YORK, May 8 —The convention and exposition have monopolized the attention of the electrical public here this week, but as you have separate reports of these events, I will content myself with brief mention of a few items of interest:

Governor Morton has signed the bill providing that elevated railway companies in cities of over 1,200,000 inhabitants shall equip their cars with the most "approved system of lighting passenger cars no v in use upon railroads, either by electricity or gas of not less than 18 candle power" There has been a great outcry against the bad light of the oil lamps on the Manhattan roads.

At Monday's meeting of the East River Bridge trustees the electrical equipment necessary for running cars on the bridge was considered. The executive committee turned over two bids which had been submitted. One was from the executive committee, offering to supply electricity for $196.21 a day, or $72,993 a year, figuring on a basis of 12,600 kilowatts. The Brooklyn Heights Railroad company offered to furnish a like quantity for $188 a day, or $68,620 per year. Chief Engineer Martin submitted an estimate setting forth his belief that a plant for furnishing the desired supply of electricity could be built for $60,500, and on this basis 12,600 kilowatts would cost the bridge only $106.50 a day. The trustees decided to erect their own plant, using the quarters now occupied by the bridge lighting plant and finding other quarters for the latter. Mr. Martin thought the new plant could be put in operation by July 1st

The Brooklyn aldermen have contracted with the Citizens', Edison and Municipal companies for lighting the streets and public buildings during the year. The price of 1,200 candle power arcs is 34 and 35 cents per night per light.

There are now 2,250 street arc lamps in Brooklyn, and it is estimated that nearly 1,000 will be added during the year. The total appropriation for street lighting, exclusive of the new wards, is about $729,000.

Mayor Strong has signified his satisfaction with the rapid transit measure. There has been more opposition manifested toward this project of late than ever before, the opponents of the enterprises evidently realizing that only a desperate struggle would now prevent an early start upon the actual work of construction. New Yorkers generally are very much disgusted with the way the scheme has been allowed to drag. A public hearing on the amendment to the Rapid Transit bill was had before Mayor Strong last week, and a vigorous protest against its provisions was made, but without avail. By the terms of the amendment the Rapid Transit commission is given the power to release the contractors from paying annually into the sinking fund one per cent. of the $50,000,000 required to build the road for the first five years after the road begins operation. For the second five years the contractor is only obliged to pay half of one per cent., providing the road makes a profit of less than five per cent. Another clause defines the equipment of the road, which is exempt from taxation, as not only rolling stock, but power houses, wires, signal system and almost everything used in the operation of the road.

W. F. O.

### Detroit, Mich.

DETROIT, April 25.—Electrical matters in Detroit are beginning to take on more than the usual amount of activity for this time of year due probably to the early season and the prospect of activity in the building line. Detroit construction men are giving especial attention just now to the new government building, as the electrical work will soon begin.

The East Side Electric company has employed Field & Hinchman to superintend the installation of its new apparatus, and anticipates a model plant at an early date.

The railway companies are planning to make further improvements in their systems, and a general electrical advance is confidently expected. C.

### Northwestern Notations.

MINNEAPOLIS, May 9 —W J Rogers bought the Le Mars, Ia., electric light and water works plant at foreclosure sale for $83,000.

J H Merrill has been appointed receiver for the Ottumwa, Ia, Electric Railway, Light, Power & Steam company Its capital stock is $500,000

The People's Power company of Moline, Ill., will enlarge its power plant by putting in new boilers and engines to be utilized in case of an emergency It will have as much steam power as water power, so that either will be ready in case of accident.

Mayor Smith has vetoed the resolution to extend and enlarge the street railway loop in St. Paul, on the ground that it would injure the retail district

The village of Halstad, Minn., is considering the matter of an electric light plant. About 200 incandescent lights would be needed and four arc lights.

The quiet little summer resort of Excelsior, Minn., some time since voted to put in an electric light plant, but the council has not taken any action in the matter. The Minneapolis & St. Louis Railway company warned the people that if they didn't wake up neighboring towns would get ahead of them, and it is probable that some action in the matter will be taken soon.

The plants of the Winona General Electric company and of the Winona City Railway company of Winona, Minn., were bid in at the foreclosure sale for $270,000 by F. A. Seymour, for the Winona Railway & Light company, an organization of the bondholders.

A company was all ready to begin work on an electric line at Fort Dodge, Ia., but is delayed by the action of the Board of Supervisors in not granting permission to cross the Des Moines river bridge. Action was deferred on the request until the June meeting, and it may result in the line not being completed this season.

An effort is being made to induce the Western Union Telegraph company to establish an office in the business portion of Luverne, Minn. Telephone connection with Minneapolis and St. Paul will soon be made, and it is thought that if the Western Union wants to holds it business it will heed the request. C.

## PERSONAL.

F. W. Cushing, who has been abroad several months in the interest of the telautograph of Prof. Gray, returned to Chicago last month for a brief visit.

James McLaughlin, recently with the Philadelphia Engineering Works, has been elected secretary and treasurer of the Barr Pumping Engine company, Philadelphia. W. W. Lindsay is the general manager of the latter company.

An appreciative biographical sketch of the late Franklin Leonard Pope by Francis W. Jones, accompanied by an excellent portrait of the deceased inventor, forms the principal feature of a memorial just issued. There is also an extract from the proceedings of the American Institute of Electrical Engineers, comprising the record of that organization's action upon Mr. Pope's death, the compilation forming altogether a very suitable reminder of the unfortunate electrician.

The American Institute of Electrical Engineers has been invited to send a representative to take part in celebrating the jubilee of the professorship of Lord Kelvin, which will take place in Glasgow, June 15th and 16th. President Duncan has appointed T. C. Martin, past president, to represent the Institute on this interesting occasion. Mr. Martin will sail on June 6th, and while absent will lecture before the Royal Institution on the subject of the Niagara power plant. He will be absent several weeks, and during his trip will visit his old home near London.

The many friends of Geo. D. Rosenthal the well-known St. Louis General Electric representative, will be interested to know that on Monday, April 27th, he was married to Miss Josephine Murphy, daughter of Mr. and Mrs. P. C. Murphy of St. Louis. The wedding was at six in the evening and was followed by a reception which was attended by many members of the electrical fraternity of St. Louis and a number of Mr. Rosenthal's numerous other friends outside the city. Mr. and Mrs. Rosenthal are now on an extensive trip through the East and expect to "do" the electrical convention during their stay in New York city. They will be at home at the Planter's hotel, St. Louis, after May 15th.

Chas. Holmes, purchasing agent and manager of the supply department of the Chicago Edison company, will shortly leave Chicago for a trip abroad. As is pretty generally known, Mr. Holmes is an Englishman, and it has been his desire for a long time again to visit the old home as well as get a glimpse of the continent. He leaves Chicago May 31st, arriving in New York June 1st, and on June 3d will sail on the Royal Mail Steamship "Majestic" of the White Star line for London Mr. Holmes will first visit relatives, of whom he has a large number in different parts of the island. He will then make his trip to the continent. Mr Holmes expects to be abroad about six weeks.

## ELECTRIC LIGHTING.

The election at Port Gibson, Miss, for water works and electric light plant was lost by a very small vote. Another election will be held soon.

J. G. Siebe & Son, Crystal Springs, Miss., will install a small electric light plant in their drug store with a capacity of 50 16 candle power incandescent lamps and several electric ceiling fans. Orders will be placed at once for a

direct current 110 volt dynamo and gasoline engine for this plant.

The Rochester Gas & Electric company has been awarded the contract for lighting the new county building at Rochester, N. Y.

The electric light trustees of Oxford, O. Henry Snyder and S. H Allen report that during the year ended March 16, 1896, they received $7,233.50 and expended $6,434.94, at the same time operating 55 street lamps at a commercial value of $2,600. Water rents are figured in the receipts, however.

## ELECTRIC RAILWAYS.

Before the summer closes it will be possible to travel from Lake Erie to Lake Ontario by trolley lines. The last link in the chain of roads that will make this trip possible is now about to be built by the construction of an electric road between Lewiston and Youngstown. The new line will be about seven miles long and run through a beautiful country.

According to a dispatch from Elgin, Ill., the Carpentersville, Elgin & Geneva Railway company has made a contract with the Yawger Construction company of Bucyrus, O., for the construction of an electric railway from Elgin to Geneva. The construction company agrees to have the line completed from Elgin to the Northwestern depot in Geneva by June 1st.

The proposed mail service by trolley car between Niagara Falls and Buffalo is still being considered by the officials of the Postoffice Department in Washington, who, it is stated, await a report from the railway mail officials of Buffalo. There is hope that the service will be instituted about June, and if it should be it will probably be an important factor in the operation of the road should a strike occur thereon.

## TELEPHONE.

The Telephone & Electric Specialty company of Memphis, Tenn., has closed a contract with Dimond & Harvey of Winona, Miss., for a 60 telephone switchboard and 40 telephones.

The contract for the telephones, switchboards and other apparatus for the new telephone exchange of the Home Telephone company of Fort Wayne, Ind., has been let to the Western Telephone Construction company of Chicago. This contract carries the entire apparatus equipment and provides for one of the most extensive modern telephone exchanges, independent of the Bell company, in the United States. There will be immediately shipped under this contract capacity for 1,000 subscribers, including switchboards, etc. The amount of total equipment to come during the year will be about double, and will probably exceed $50,000 in cost. President Keelyn of the Western Telephone Construction company, speaking of these boards, said: "It will be a surprise even to telephone men when they witness the operation of these switchboards, as they contain several remarkable improvements for facilitating the work of the operators and quickening the response to subscribers' calls. There is no doubt that there will be 2,000 or more telephones connected with the exchange within the year, and we are arranging accordingly. The improvement in service over the old system will be a pleasant surprise to the patrons, and the old Bell system will necessarily have to give way to modern and improved methods. It is a 'survival of the fittest.'"

## MISCELLANEOUS.

The leading attraction of the Rhode Island state fair, to be held at Narragansett Park, Providence, R. I., in September, will be an exhibition and contest of horseless carriages. The sum of $5 000 will be awarded in prizes, but the details of the races have not been settled as yet.

The national convention of credit managers of banks, mercantile houses and manufacturing establishments will be held in Toledo on June 23d, 24th and 25th. It is expected that this meeting will result in the perfecting of a national organization of creditors, concerning which so much has been written of late years.

The "Cornell University Register" for 1895-96, a closely printed volume of 282 pages, is at hand. It is interesting to note that, although intending students are warned not to enter the course in electrical engineering "unless strong in mathematics, both pure and applied, and in physics," there are more undergraduates in this course than in any other offered at the institution. Nearly 300 students are classed under this head. Doubtless the wide reputation of Cornell's electrical department for thoroughness and encouragement of original work explains this.

## TRADE NEWS.

The Cutter Electrical & Manufacturing company manufacturer of the C. S. flush push switches and the I. T. E. circuit breakers, has removed its western office to suite 15 9-10-11 Monadnock block, Chicago.

In order to give better service to customers, the Law Battery company has removed its office from 29 Cortlandt street, New York, to its factory at Cranford, N. J.

The cutting and notching tools for armature disks and sections made by the E. W. Bliss company of 17 Adams street Brooklyn, are illustrated in a recent catalogue, which will be found valuable by all electrical manufacturers.

Langstadt & Crosswell the electrical contractors of Appleton, Wis. report business as good, with a bright outlook for the future. They are now installing a lighting plant for the D. K. Jeffries Lumber company of Jeffries, Wis.

The W. S. Hill Electric company of New Bedford Mass., has been reorganized under the laws of Massachusetts with a capital stock of $70,000. With its large new factory this company is in a better position to handle business than ever before.

The Chicago Armature company announces the removal of its office and factory to 14 and 16 North Canal street, where it has more commodious quarters and increased facilities for meeting the daily increasing demands of its business.

The new 10-story office building of Louis Reibold in Dayton, Ohio, said to be the finest in the state of Ohio, will be equipped with two Sprague multiple sheave screw electric elevators supplied with current from the street mains. The order was secured by C. A. Benton.

The Peru Electric Manufacturing company of Peru, Ind., announces some new things in fuse boxes, rosette cutouts and "pony" wall receptacles. The fuse boxes can be built for from four to 100 circuits and are pronounced entirely satisfactory. The workmanship and finish are of the best.

Probably no mica firm is doing a larger business at the present time than Bowers Brothers, 121-123 Lake street, Chicago. This firm has found it well nigh impossible to keep up with the large number of orders which have recently been received. The product of Bowers Brothers has become well known among electrical machinery manufacturers and other users throughout the country

The Cutler-Hammer Manufacturing company Chicago, has purchased the plant of J. Holt Gates. This includes the fine machinery, tools, etc., which were used by the Gates company. The Cutler-Hammer company will thus be enabled to treble its facilities for the manufacture of rheostats, which are its sole product. The company is now moving into the new shop, which is located in the Dunn building, corner Jackson and Clinton streets.

Franklin Brooks, junior member of the firm of Eugene Munsell & Co., 218 Water street New York, miners and importers of mica, was recently welcomed home from his trip abroad by his friends. The features of the trip were discussed at the dinner, which was tendered him, with greater interest than the menu. Mr. Brooks has been away some six months on a business and pleasure trip, including in his itinerary London, Paris and Monaco; then through the Mediterranean Sea and Suez canal to India, where he spent two months in the mica fields, in which the company is largely interested. He brought home a large number of photographs, which are very interesting and which have been procured at a great deal of expense.

The Julius Andrae & Sons company of Milwaukee has been awarded the contract for wiring the new large insane asylum at Newberry, Mich.; also the state horticultural building at Madison for electric lights. The electric light plant on the steamer Lora has been entirely remodeled and put in best of condition by this company, which will also equip Kieckhefer Brothers' extensive tinware factory with a system of telephones, signal bells and watchman's clock. The Plankinton house barber shop will be wired for nearly 200 lights, and when completed will be the most artistic shop of this kind in the state of Wisconsin. Besides these, the Andraes have a number of smaller contracts which keep them busy. The telephone business is booming; the company receives orders by nearly every mail. It has sold a large quantity of supplies for new exchanges, and also has had an expert for the last two weeks putting in new apparatus and fixing up the lines for the Badger and Wolf River Telephone companies.

The Western Telephone Construction company announces that it has closed the largest single contract for a telephone exchange equipment ever made, either by an independent manufacturer or by the Bell company. The contract covers nearly seven thousand telephones with switchboard equipment to match. This equipment is for a large American city, the location being still kept secret. It is asserted that this system will demonstrate a central office system as much superior to the Bell "express" system as the latter is to the old Gilliland. It is confidently expected that the new Keelyn system for large exchanges (which has quietly been perfected, awaiting the development of large exchanges) will prove a genuine surprise to the telephone people both in and outside the Bell camp. Competent telephone engineers, who have seen the first installment of these switchboards and witnessed their operation, have been astonished at the simplicity of operation and uniqueness of design for rapid manipulation. Mr. Keelyn's design is a radical departure from multiple drop systems, which he holds should have been displaced by better methods long since. Mr Keelyn has provided a districting system purely original with him, and covered by patents, which admits of extending the system from 1,000 to 10,000, without any radical changes in the switchboards proper. He claims that this is the only method yet devised which will admit of large extensions without change of switchboard, except by the slower type or old transfer-jack systems, which he also holds will necessarily have to give way to something capable of rapid and good service. The transfer system requires an extra board for every two boards used in a system of 1,000 to 1,200, and then although using a large number of operators, is too slow and troublesome for even fair service. The new Keelyn multiple system only requires the number of drops and jacks to correspond with the number of subscribers' lines.

## BUSINESS.

Jules Viennot, the widely-known advertising agent of Philadelphia, has removed to rooms 9 and 10 at 524 Walnut street.

The Lakon company, manufacturer of the Lakon transformer, has removed its Chicago office, which is in charge of F. S. Terry, to suite 1509-10-11 Monadnock block.

The Sunbeam Incandescent Lamp company, Chicago, has removed its offices from the Title and Trust building to suite 1509-10-11 Monadnock block, where it will have much more commodious quarters.

The Manhattan General Construction company has been appointed New England agent for the Siemens & Halske Electric Company of America, and has opened a new office in the John Hancock building, Boston, with H. C. Spaulding as manager,

The alternating current fan and power motors made by the Emerson Electric Manufacturing company of St. Louis are well known to the trade. The Meston type has a wide reputation, and in a recent pamphlet the company directs especial attention to its 16-inch fan motor and to the new Emerson power motor.

With characteristic enterprise, the American Electrical Works are sending out a cardboard folder giving timely information about Cuba. A map of the island, a representation of the revolutionists' flag, and general statistics of history, geography and industry will prove of interest to those following the incidents of the struggle now in progress.

The Electric Appliance company is carrying a large and well assorted stock of the celebrated Electra imported carbons, which are recognized as of very high grade, having an exceptionally long life, owing to the fact that almost the entire carbon is consumed, the amount of dust being reduced to a minimum. Prompt shipments are made from Chicago stock.

E. P. Roberts, consulting engineer and president of the Correspondence School of Technology, Cleveland, Ohio, has been appointed consulting engineer for the Port Clinton, O., Electric Light & Power company. Mr. Roberts is also consulting engineer for the Columbus state hospital and the state insane asylum at Massillon, O. Bids for these plants will be called for within the next 30 days.

The Standard Paint company of 81 John street, New York writes: "John Jordan of Schiff, Jordan & Co. of Vienna is now here. As we believe you are aware, our company is sole agent and importer of the Ship carbons manufactured by Schiff, Jordan & Co. Mr. Jordan is here looking over matters generally, and before returning will visit all the large cities in the United States. We are now making an active push on carbons with very gratifying results. We quote from a letter just received from one of our best customers: 'As far as we can learn all of our customers to whom we have sold the Ship carbons have found them perfectly satisfactory.' We have just received large consignments of carbons from Vienna and are, therefore, in a position to fill orders immediately from stock."

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued May 5, 1896.*

559,349. Rheostat. William S. Andrews, Schenectady, N. Y. Application filed December 12, 1895.

A resistance card is the feature of the invention, and it consists of insulating material wound with a metallic conductor, and folded upon itself lengthwise so as to bring the ends of the conductor at one end of the card.

559,356. Electric Railway. Henry Brandenburg, Chicago, Ill. Application filed March 11, 1895.

The rail for electric roads is formed integral in cross-section, having the tread surface for the wheel and the longitudinal chamber or cavity formed in the body thereof, with a relatively narrow longitudinal slot or opening leading to the chamber.

559,357. Electric Railway. Henry Brandenburg, Chicago, Ill Application filed May 2, 1895.

The trolley has two independently pivoted contact shoes for coöperation with each conductor.

559,366. Switchboard for Telephone Exchanges. Joseph P. Davis, New York, N. Y. Application filed August 10, 1895.

An annunciator switchboard is provided with a connection socket and an annunciator for each telephone line of the exchange, and a multiple switchboard of several sections is also provided, each having in it a terminal connection socket of each line of the exchange, and trunk lines extending from the annunciator board to each section of the multiple board.

559,367. Switching Apparatus for Telephone Exchanges Joseph P. Davis, New York, N. Y. Application filed August 10, 1895.

Several telephone lines terminating in connection sockets on different switchboards, an indicator adapted to indicate any of several objects for one of the lines in an annunciator board, and means for controlling the indicator from the sub station, and trunk lines from the annunciator board to each of the switchboards

559,376. Composition for Electric Insulation and Process of Making Same. Adolf Gentzsch, Vienna, Austria-Hungary. Application filed April 5, 1893.

This composition consists of shellac and rosin, of birch tar oil and anilin oil, and of anthracene.

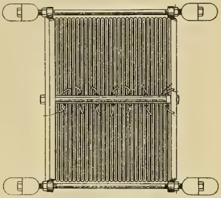
559,380. Electric Motor and Motor Generator. Ludwig Gutmann, Chicago, Ill. Application filed July 10, 1894.

A motor is provided with field magnet coils adapted to be traversed by currents of the same phase, an armature is provided with coils, the number of which is different from the number of field poles or positions of maximum magnetic flux, and an additional field coil or set of coils is adapted to be traversed at starting by a current of displaced phase.

559,387. Electric Arc Lamp. Albert Jordan, Vienna, Austria-Hungary. Application filed February 12, 1896.

Essential features of this lamp are: A carbon and mechanism for feeding the same, and two rolls rotating in fixed bearings, and both adapted to rest at their peripheries upon the conical end of the carbon, and to permit of the feeding of the same only by the consumption of the end thereof.

559,394. Indicating and Registering Apparatus for Meters. Paul Marix, Paris, France. Application filed December 27, 1895.



NO. 559,349.

There are a moving diagram card or chart, upon which the record is made, a pivoted lever carrying at one end a marker in contact with the diagram card or chart, and being notched at its other end, electro-magnetic mechanism in proximity to the lever, circuit-connecting devices controlling the energizing circuit for the magnet, whereby the lever is shifted from one position of contact on the diagram paper or chart to another, making distinct lines corresponding to different periods, such as periods of rest and of work respectively.

559,397. Electric Signaling Apparatus. Thomas G. Morse, Erie, Pa. Application filed October 8, 1895.

This apparatus includes an electrical supply, an electric circuit, mechanism operating upon the circuit to effect a signal, a closed box containing the mechanism, a locking means for normally locking the signal operating mechanism against movement, a "pull" mechanism extending without the box, means actuated by the pull mechanism for releasing the signal-operating mechanism, and a catch that locks the pull mechanism against actuating a second operation.

559,407. Electric Arc Lamp. Charles E. Scribner, Chicago, Ill. Application filed December 30, 1893.

This is an open-circuit electric arc lamp, with a cut-out circuit therefor, an electro-magnet in shunt of the carbons, an armature therefor controlling the continuity of the cut-out circuit, clutch mechanism connected with and controlled by the armature, a feeding armature controlled by an electro-magnet in shunt of the carbons, and a yielding connection between the feeding armature and the cut-out armature, the feeding armature being adapted when unduly attracted to bring the cut-out armature within range of its electro-magnet.

559,408. Electric Arc Lamp. Charles E. Scribner, Chicago, Ill. Application filed January 9, 1894.

One claim is for the combination with the carbon rod, of a collar moving therewith, a switch in the path of the collar, a normally excited electro-magnet adapted to cause the movement of the contact in the direction of normal movement of the carbon, and a shunt of the magnet controlled by the switch contact and collar.

559,409. Telephone Circuit for Police Boxes. Charles E. Scribner, Chicago, Ill. Application filed January 26, 1894.

One claim is given The combination with a police-box containing a break wheel and its contact points, and the electric magnet of a signal bell included in a signaling circuit connected with a central station, of a shunt circuit about the police-box including two condensers, and a telephone connected from a point of said shunt circuit between the two condensers, the other terminal of the telephone being connected to a return conductor to the central station.

559,410. Apparatus and Circuit for Telephones. Charles E. Scribner, Chicago, and Frank R. McBerty, Downer's Grove, Ill. Application filed January 8, 1895.

This invention comprises two closed telephone circuits, a source of telephonic current in one of the circuits, a telephone receiver in the other circuit, two branches, each uniting one side of one telephone circuit with the corresponding side of the other telephone circuit, two impedance coils included in each of the branches, and a conductor uniting the branches connected with each of them at points intermediate of the two impedance coils, whereby cross-talk between the lines is prevented.

559,411. Apparatus for Telephone Switchboards. Charles E. Scribner, Chicago, and Frank R. McBerty, Downer's Grove, Ill. Application filed February 25, 1895.

The inventors claim the combination with the connecting plug and the circuit thereof, of the spring-jack to receive the plug, registering contact pieces in the plug and spring jack constituting the normally separated terminals of a local circuit, [illegible] signal [illegible] in parallel branches of the local circuit and independent relays controlling the [illegible] the relays being connected with the plug circuit [illegible] to currents through the different [illegible] of the pair.

559,412. Electric Arc Lamp. Rudolph Segerdahl, Chicago, Ill. Application filed September 10, 1895.

Features of this invention are: A flexible carbon rod formed from a spirally coiled wire and a guide or support around which the flexible carbon rod is adapted to be bent.

559,416. Electric Push Button. George J. Soper, Brooklyn, N. Y. Application filed May 17, 1895.

The arrangement consists of a base plate provided with an externally screw-threaded neck, and adapted to be secured to the wall of the building, an insulating block secured within the neck, and provided with fixed and movable contacts, an internally screw-threaded cap provided with a central opening, a push-button proper guided by its shank in the central opening, and a removable finishing plate provided with an opening to receive the screw-threaded neck, and with an external guard flange which is adapted to seat against the wall of the building, the finishing plate being confined by the screw-cap.

559,419. Inductor Dynamo. Charles P. Steinmetz, Schenectady, N. Y. Application filed February 15, 1896.

This machine has inwardly projecting pole pieces provided with field magnet windings, armature coils mounted upon the polar faces, and a revolving inductor.

559,461. Trolley Wheel. John McKenna, Johnstown, Pa. Application filed March 2, 1896.

There is a separable inner wearing flange on each side of a central hub, and an outer supporting flange fitting against the inner flange, and adapted to support the outer edge of the same.

559,476. Telephone Transmitter. Louis D. Appleman, Waynesborough, Va. Application filed May 25, 1895.

The principal parts of this device are a diaphragm, a bridge secured to the back of the diaphragm and an electrode carried by the bridge, a carriage supported above the bridge, conducting pencils loosely hung in the carriage, and hanging between the diaphragm and the electrode, resting upon the latter.

559,479. Telegraphic Relay. Charles G. Burke, Brooklyn, N. Y. Application filed November 21, 1895.

A rotary coil for relay instruments is adapted to be suspended or supported in a magnetic field, and consists of a spool or core with a conductor wound thereon in convolutions parallel with its axis, the direction of the winding being opposite in opposite halves of the coil, and no two immediately successive convolutions or paths in the same direction being contiguous to each other.

559,518. Automatic Time Recording Instrument. Howard F. Eaton, Quincy, Mass. Application filed March 20, 1893.

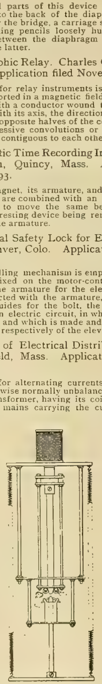
An electro-magnet, its armature, and a printing member moved thereby are combined with an arresting device, an electro-magnet to move the same beneath the printing member, the arresting device being removed therefrom by movement of the armature.

559,529. Electrical Safety Lock for Elevators. Albert C. Hunt, Denver, Colo. Application filed January 17, 1896.

Motor controlling mechanism is employed, and the electro-magnet is fixed on the motor-controlling mechanism, together with the armature for the electro-magnet, a locking bolt connected with the armature, guide pins for the locking bolt, guides for the bolt, the stationary recessed segment and an electric circuit, in which is included the electro-magnet, and which is made and broken by the opening and closing respectively of the elevator shaft door.

559,530. System of Electrical Distribution. John F. Kelly, Pittsfield, Mass. Application filed November 20, 1895.

In a system for alternating currents of different phase having an otherwise normally unbalanced mutual induction a balancing transformer, having its coils in series respectively with the mains carrying the currents of different phase.



NO 559,387.

559,531. Dynamo-electric Machine. John F. Kelly, Pittsfield, Mass. Application filed January 18, 1896.

Claim is made for an armature consisting of two stationary laminated rings, having between them a magnetic bridge formed of bolts or bars.

559,576 Electric Railway Signal System Laban J. Everest, Omaha, Neb. Application filed July 12, 1895

A spring actuated train of gearing and an actuating lever are employed, together with swinging rectangular levers secured to a shaft arm a contact point is normally suspended by the arms, the contact point comprising a spool mounted upon the vertical shaft, and a second contact point below the suspended contact point, the contact points forming electrical terminals in connection with a suitable electric circuit, the instrumentalities being so arranged that as the train of gearing is actuated the suspended electric terminal is permitted to drop and complete the circuit.

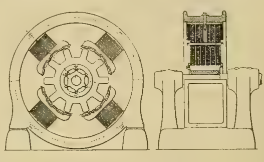
559,584. Dynamo-electric Machine. John F. Kelly, Cummings C. Chesney and Pomeroy W. Power, Pittsfield, Mass. Application filed January 22, 1896.

A revolving inductor is employed, with a stationary armature, an energizing coil and stationary copper bobbin surrounding the revolving inductor, the bobbin carrying the energizing coil.

559,585. Electric Current Regulator. Alvaro S. Krotz, Springfield, Ohio. Application filed January 22, 1894.

A sectional solenoid is provided, each section of which consists of two coils of wire wound in opposite directions, and connected together at the center so as to bring their free ends on the outside, exposed metallic plates forming an electrical connection between the respective sections, a contacting device moving with the core of the solenoid, so as to contact with the plates, the contacting device having a high resistance, being of a size sufficient to contact with two or more of the plates.

559,586. Electrical Contact Device for Subways or Conduits. Alvaro S. Krotz, Springfield, Ohio, and William P. Allen, Chicago, Ill. Application filed November 14, 1895.



NO. 559,419.

A contacting device is described, consisting essentially of spring standards, having contacting shoes, a supporting post formed of steel plates secured together through the medium of spacing blocks, and insulating material included between the plates and spacing blocks, and a frame for supporting the head or post.

559,616. System of Current Supply for Telephones. Charles E. Scribner, Chicago, Ill. Application filed January 8, 1895.

The combination with a telephone circuit, of a microphone and a telephone in the circuit, a condenser included in the circuit between the microphone and the telephone, and a source of electric current for supplying the microphone connected through a resistance coil with that portion of the line including the microphone.

559,648. Electric Arc Lamp. Malone Wheless, Washington, D. C. Application filed December 7, 1895.

Features of this invention include the feed-yoke, the cap or dome, the counter-weight track jointed to both the dome and the yoke, and the counter-weight carried by and freely movable on the track.

559,649. Electric Arc Lamp. Malone Wheless, Washington, D. C. Application filed January 29, 1896.

The feed magnet or magnets included in the arc circuit of the lamp, and the feed mechanism controlled thereby, in combination with the regulator magnet included in a high resistance, shunt from that circuit, and a shunt circuit around the arc, and the feed and regulator magnets completed through either one of two sets of contacts, controlled by the regulator magnet according as the potential of the arc circuit materially exceeds or falls below normal.

559,685. Rheostat. Harry P. Davis, Pittsburg, Pa. Application filed July 10, 1895

A rheostat comprising a box, circumferentially arranged resistance coils in the box and projecting at their lower ends through the bottom thereof, two sets of plates mechanically and electrically connecting the coils in series, one of the sets of plates being inside of the box at the top, and the other set being outside at the bottom, and a set of contacts projecting through the top of the box and respectively joined to the adjacent connecting plates.

559,692. Armature for Electric Motors and Dynamos. Jonathan P. B. Fiske, Alliance, Ohio, and Howard A. Littlefield, Lynn, Mass. Application filed December 14, 1894.

Together with an armature core or drum having annular extensions at its ends, a series of coils is disposed on the core or drum, and having their ends disposed on the annular extensions.

559,701. Conduit for Electric Lines. Jean Graizier, Geneva, Switzerland. Application filed November 4, 1895

An insulating conduit is described, consisting of a trough of concrete and a cover therefor, a bottom layer of pieces of broken refractory insulating substances, and bituminous material filling the interstices, and cross bearers of terracotta or similar material having recessed upper edges and laid therein at intervals, longitudinal groups of conductors laid upon said layer of insulating material and within the recesses of said cross-bearers, and a second layer of such insulating material above the conductors.

559,721 System of Electrical Distribution Benjamin G. Lamme, Pittsburg, Pa Application filed April 11, 1895

This arrangement comprises two circuits carrying currents differing approximately ninety degrees in phase, two transformers having their primaries respectively included in the circuits, and their secondaries connected in series, one of the secondaries comprising two independent reversely wound sections.

559,752 Electric Arc Lamp Carbon Josef Roubal, Prague, Austria-Hungary. Application filed December 27, 1895

The process described of treating electric arc light carbons to prevent the oxidation on the surface while burning, and thereby lengthen the burning time of the carbon, consists in coating and incrusting the carbon with a mixture of pure carbon and a silicate preferably silicate of an alkali or boric acid.

Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, MAY 23, 1896. No. 21

## Direct Conversion of Carbon into Electrical Energy.

About two months ago a brief note, accompanied by an illustration, appeared in the Illustrated Electrical Patent Record of the WESTERN ELECTRICIAN, announcing the granting of a patent to William W. Jacques of Newton, Mass., covering the "Method of Converting Potential Energy of Carbon into Electrical Energy." The essential feature of the patent was thus described: "The process consists of converting the potential energy of carbon or carbonaceous material into electrical energy by chemically combining oxygen with the carbon or carbanaceous material through an intervening electrolyte."

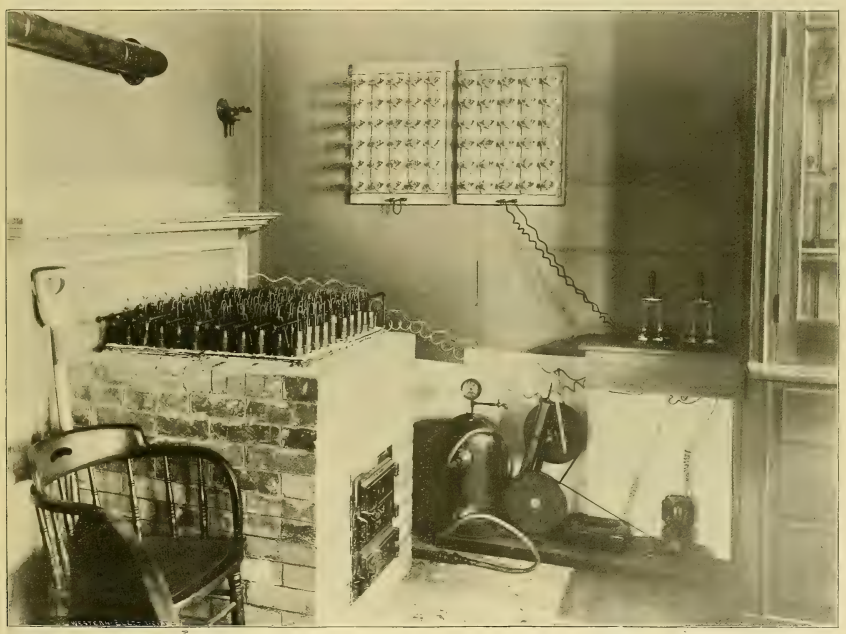
The problem which this invention claims to have solved is one that has occupied many brilliant minds. It has been stated by Prof. Ostwald that "had we a cell in which electrical energy was produced by the direct oxidation of carbon, with an output approaching the theoretical, we should be on the brink of an industrial revolution compared with which the invention of the steam engine sinks into insignificance." This is what Dr. Jacques claims to have accomplished, and he is supported in this position by many eminent physicists who have witnessed the results of his experiments and examined his invention.

An idea of the widespread interest that has been awakened in this discovery may be gained from the fact that immediately following the publication of the patent, which was issued on March 3d, the Patent Office was besieged with inquiries about the invention, and demands for copies of the specifications were so numerous that the supply was soon exhausted.

The invention described in the patent was the result of considerable study and research by the inventor. Early in his experiments Dr. Jacques conceived the idea that the oxygen of the air might be made to combine with carbon, not directly, but through the aid of an intervening electrolyte, which should carry it and present it to the carbon. For the electrolyte he selected caustic soda. To carry out this conception he took an iron pot which became in itself one of the elements of his cell, and into this he put caustic soda, which, at normal temperatures, is a solid. Applying heat, and raising the mass to the moderate temperature of 300 degrees, it fused, giving the desired liquid electrolyte. Into this was plunged a stick of carbon, and an iron tube was then thrust down into the molten mass, almost to the bottom, and through this, by means of a pump, air was forced, which came bubbling up to the surface. But not all of it. The electrolyte caught and held a part long enough to present it to the surface of the carbon, which immediately accepted and combined with the oxygen which formed a part of the air within its reach. Here, it is claimed was secured true and perfect oxidation, and with it consumption of but two things, carbon and air. The electrolyte was not attacked chemically. It was not decomposed or deteriorated. It stood ready to perform its function of carrying air to the carbon as long as the supply lasted.

It was found, the carbon and the pot being connected by wire, that a current of considerable volume flowed through it, and that, within limits, the amount of that current was proportioned to the volume of air supplied. It was also shown that the ebullition produced in the mass by the passage of the air through it had the effect of keeping the surface of the carbon free from particles of ash and other impurities, and that it had other advantages as well.

A gentleman who has followed Dr. Jacques' experimental work closely and is acquainted with all the details of the invention has furnished the WESTERN ELECTRICIAN a description of the process and a photograph, from which the accompanying picture was made. The



DIRECT CONVERSION OF CARBON INTO ELECTRICAL ENERGY.

illustration shows a corner in Dr. Jacques' experimental laboratory. An early form of the carbon electric generator, which has now been in operation for six months, is seen to the left, the tops of the one hundred cells showing, with their connections. To the right of this is the air pump, driven by a portion of the current generated, and above it, on the wall, the electric lamps operated. The two switches on the small shelf are used, the one for switching that portion of the current used for the pump, the other for cutting the lamps in and out of circuit.

For the construction of this generator Dr. Jacques provided 100 iron pots, each 12 inches deep and $11\frac{1}{2}$ inches in diameter. These were set in 10 rows of 10 each, and suspended over a grate, the whole being bricked in to retain the heat. In each of these a suitable amount of caustic soda was put, and this was

fused by fire beneath. Then on each a cylinder of carbon was suspended, and the carbon in each pot was connected by a wire with the rim of the next adjoining pot. Wires leading from the first pot and the last carbon constituted the terminals of the generator. Reaching down into each pot was an air tube, and these were all so connected above as to take air from a force pump. The terminals being connected through a series of incandescent lamps, current was generated which caused them to glow, the pump being driven by a motor actuated by a small portion of the current.

At this point Dr. Jacques invited Professors Rowland and Cross and Stone & Webster to examine the apparatus and make tests of efficiency. In his report Prof. Rowland said:

It has long been known that, if the oxygen of the air, or free oxygen, could be made to combine with carbon in such a way as to produce electrical energy, instead of heat, an enormous economy would be effected. Dr. Jacques has accomplished this, and I believe he is the first who has done so. Not only is Dr. Jacques the first to my knowledge to show how the oxygen of the air, or free oxygen, may be made to combine with carbon to produce electrical energy, but he is the first to show, so far as I know, any practically operative process by which electricity may be produced through the oxidation of carbon.

Prof. Cross, under whose supervision the tests were made, has prepared an extensive report in the course of which he says:

When Dr. Jacques first showed me his electrical generator I recognized at once that he had succeeded in effecting a continuous development of electricity from the oxidation of carbon, such as had previously been sought for in vain by the many persons who had essayed to attain the same results. . . . This is not a process in which there is ordinary combustion, involving a conversion of the potential chemical energy of carbon into heat with an accompanying incidental and slight production of electricity, but one in which the potential energy of the carbon is transformed into electrical energy without the development of heat to any material extent, the reasoning it entirely from devices in which ordinary combustion of the carbon and electrolyte takes place.

The tests alluded to were conducted by Stone & Webster of Boston under direction of Prof. Cross. Dr. Jacques had operated 30 16 candle incandescent lamps at full brilliancy, and it was desired that the amount of carbon consumed be ascertained and a comparison made with the amount required to do the same work by using present methods. It was found that to maintain these lights for 18¾ hours required the consumption in the pots, by oxidation, of about eight pounds of coal. It was also found that the average pressure was 90 volts and that the average amount of current was 16 amperes. It was also determined, by careful measurements and calculations based thereon, that the electrical energy actually obtained from one pound of carbon consumed in the pots was 82 per cent. of the theoretical. In connection with this, it was stated that in large plants, with boiler, engine and dynamo, the average energy obtained from a pound of coal is but six per cent. of the theoretical. In these tests the amount of coal consumed in keeping the electrolyte contained in the pots at the required temperature was not taken into the account, the reason given being that "the coal burned on the grate would be much smaller in a generator of larger size." In this connection the report says: "It is, perhaps, fair to say that we may expect the carbon electric generator to yield 10 times as much electricity per pound of carbon as does a good average steam engine dynamo plant." In this estimate the fuel burned in the grate is included in the carbon consumed.

The inventor of this process, Dr. William W. Jacques of Boston, is an electrician and chemist of high standing, who pursued his studies at Johns Hopkins and in Europe, and has been in the employ of the American Bell Telephone company as its electrician from the beginning. He was peculiarly fitted and equipped for work of the kind required in developing the carbon electric generator, as he had had long experience in research and experiment. He is said to be a very accomplished gentleman, and the attention which the announcement of his discovery awakened in the scientific world shows that he enjoys an excellent reputation.

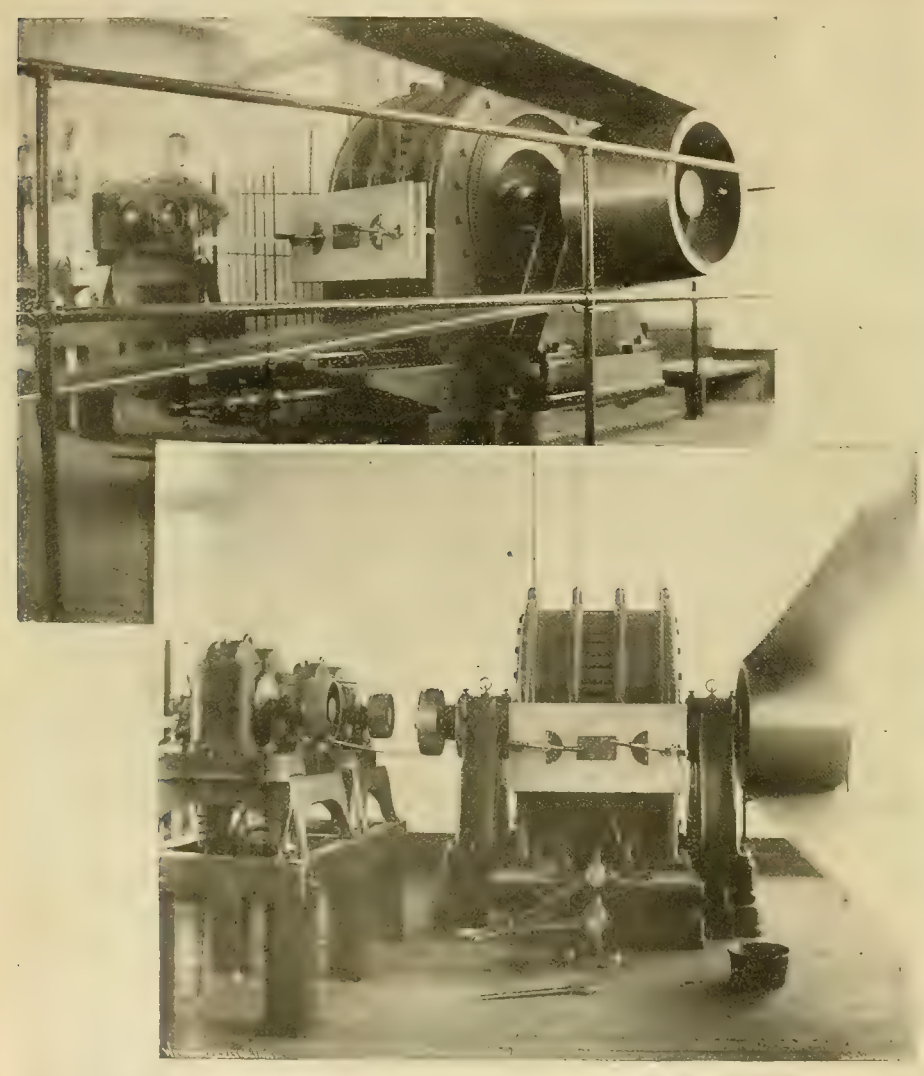


FIG. 1. POWER TRANSMISSION FROM LOWELL TO GRAND RAPIDS, MICH. TWO VIEWS OF THE 200-KILOWATT GENERATOR AT LOWELL.

## Power Transmission from Lowell to Grand Rapids, Mich.

By J. B. W.

The value of water power, as compared with energy developed by a steam plant, is pretty generally understood and appreciated, but until recent years it has been necessary, to utilize this cheaper source of power, to locate directly upon it and to connect by mechanical means with the water wheels. The introduction of high voltage electrical apparatus has changed all this and given a commercial value to water power rights heretofore unused, and made practical and exceedingly profitable the transmission of energy long distances to an established demand for it at market rates for general distribution in either lights or motor power service.

FIG. 2. POWER TRANSMISSION FROM LOWELL TO GRAND RAPIDS, MICH.—DAM IN THE FLAT RIVER AT LOWELL.

One of the longest electric transmission lines east of the Mississippi river has recently been installed at Lowell, Mich., by the Lowell Water & Light company. The power house is situated about one mile east of the town upon the Flat River, a tributary of the Grand. On the east side of the river is a large waste weir, which is used in time of high water. The dam is shown in Fig 2. The power house (Fig. 3), a substantial brick building, is located upon the west bank. In the basement of the building are three vertical turbines of 100 horse power capacity each (Fig. 4), two of them being Leffel and one a New America Special. These wheels furnish power for driving one 200 kilowatt "S. K. C." alternating current generator, shown in Fig. 1. The pumping machinery which supplies water for the village of Lowell is also located here. The wheels are so arranged that any one may be connected or disconnected to the main line shaft by means of clutches, thus making it possible to throw any wheel in or out without shutting down the plant. The generator is belted to this line shaft and supplies current at 1,000 volts. The town of Lowell is supplied at this voltage. Step-up transformers raise the current from 1,000 to 10,000 volts, and at this high potential supply the transmission line, upon which it is carried to Grand Rapids, 18 miles away, and there reduced by means of step down transformers to 2,000 volts and distributed for light and power indiscriminately. Eight thousand alternations are used in this work, and the motors of the "S. K. C." type, with condensers, are used exclusively for power.

FIG. 3. POWER TRANSMISSION FROM LOWELL TO GRAND RAPIDS, MICH.—GENERATING STATION AT LOWELL.

The marble switchboard (Fig. 5) in the Lowell station is perfect in its adaptation and equipped with the best apparatus obtainable for high voltage work. Two two-pole switches and two "S. K. C." circuit breakers control the Grand Rapids lines, while the Lowell circuit is similarly controlled.

The generator is furnished with regulator heads, by which the voltage of either phase may be raised or low-

ered independently of the other, thus making it possible to throw the load of the Lowell circuit upon either phase and yet maintain a perfect balance of voltage at Grand Rapids, over 18 miles away.

The pole line is of the most modern construction and very substantial, consisting of 30 foot poles with not less than six-inch tops, set 100 feet apart. The four No. 6 wires are carried upon two cross-arms, as shown in the woodland view in Fig. 6, and are so arranged as to make a square having 18-inch sides, the diagonal wires of which form the circuits for each phase of the generator. They are supported upon the Locke triple petticoat porcelain insulators, which give very perfect insulation, the leakage being extremely small even with a pressure of 12,000 volts upon the lines. The circuits are protected from lightning discharges by stringing a barbed iron wire over the tops of the poles, which is grounded at every other pole. For indicating grounds upon the high voltage lines static ground detectors are used.

The Stanley Electric Manufacturing company and the Lowell Water & Light company have in this installation practically demonstrated that power can be carried long distances at high voltages through a thickly settled region and distributed for an indiscriminate use for arc and incandescent lights and power with perfect success, and that by using these high voltages the losses in the lines can within a commercial basis be reduced to less than the average losses in the distributing circuits of low tension direct current central stations in large cities.

The officers of the company are: President, O. C. McDonald; secretary and treasurer, Charles A. Church; superintendent, L. W. Kutsch. The pole line was constructed under the supervision of M. M. Wood of Chicago, and the installation of the electrical equipment was made by W. B. Jackson, one of the engineers of the Stanley Electric Manufacturing company.

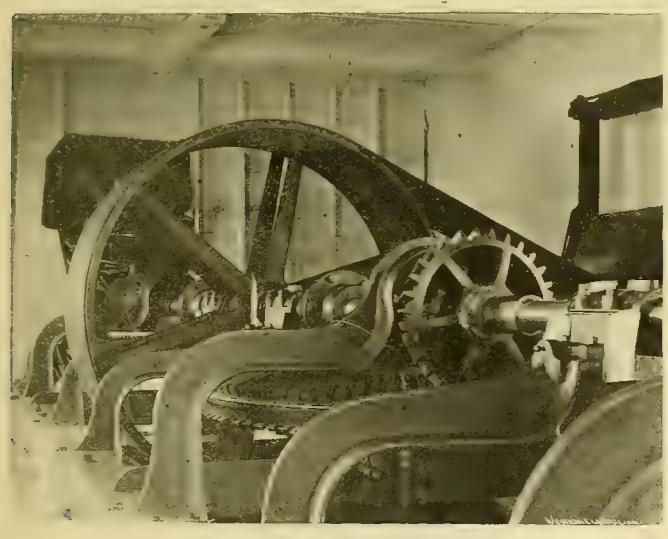


FIG. 4. POWER TRANSMISSION FROM LOWELL TO GRAND RAPIDS, MICH VIEW IN THE WHEEL ROOM.

## Milwaukee Street Railway Trouble.

Under date of May 16th the Milwaukee correspondent of the WESTERN ELECTRICIAN writes as follows:

The Milwaukee street railway strike has now resolved itself into a boycott. So far as the operation of its lines is concerned the company is about as well off as it was before the strike began, as for several days it has been running the full number of cars, and now the only hope of the strikers is to bring the company to terms by reducing its receipts. The strikers and their friends, although they see the lines in full operation, say they are very confident of going back to work. It is quite certain, however, that their principal demands will not be granted.

Since the failure by the joint committee of the Common Council and the Merchants and Manufacturers' association to settle the strike, two futile attempts in the same direction have been made. Early in the present week Mayor Rauschenberger called in the state Board of Arbitration, which was created by the last Legislature. The board brought about conferences between the strikers and the directors of the company, but no settlement resulted. As to the demand for arbitration the company had this to say: "We have endeavored in the past and propose to continue in the future to manage our business with a just regard to the interests of our employes, and we cannot, under the circumstances, yield the ultimate right of deciding for ourselves all questions as to the executive policy and management of the company." The company said that it was ready to comply with some of the demands of the men. In respect to the demand for an equal division of the running time of day and night crews, the company said that under the schedule which was soon to go into effect there would be no run of less than nine hours, and that it was only fair that regular men who were taken off their runs for a day to run "salters" or sweepers should receive a full day's pay for such irregular work. The present regulations in regard to the purchase of uniforms, the company stated, had been made for the purpose of allowing the men to get the best uniforms at the lowest possible prices, but if the arrangement were not satisfactory to the men it could be changed. It was after the company had stated its position that the strikers said that they were willing to return to work on the old terms if the company would take them back in a body. To this the company replied that it could not honorably discharge the men whom it had brought here from other cities to operate its lines, so long as they proved competent, to make room for the strikers. The company added that it could make room for about 250 of the strikers and would give the preference to those who had families to support. The board advised the men to take advantage of the company's offer, as it probably would not be long, the board stated, before everyone of them would be given his old place. To this the strikers replied that they stood ready to return to work, but only on condition that they be allowed to return in a body. The company refused to accept any proposition looking to the strikers going back as a body, and added that the conditions which existed had not been brought about by the company but by the men. The state board, after the men had again formally refused to go back to work except in a body, gave up its attempt to settle the strike by mediation. The board, in its formal report, speaks of the strike in the following language: "We are forced to the conclusion that the strike at the present time was ill-advised, in view of the fact that the men agreed to another conference with the directors of the company, which conference, we believe, would have settled the differences between them, and abandoned that agreement only because the arrival of the colored cooks caused them to anticipate trouble."

Ex-Governor Peck made a suggestion that the business men of the city raise a fund of $5,000 with which to return the new men to their homes, it being his idea that if the new men's expenses were paid, and they were each given a little money in addition, they would be willing to surrender their places. Acting partly upon this suggestion, a committee of business men, consisting of Bernard Goldsmith, John Johnston and Benjamin Skidmore, arranged a conference Thursday afternoon between the strikers and the directors of the company.

Again, however, the company refused to take the old men back in a body, and again the strikers refused to return to work on any other terms.

The disorderly phase of the strike has abated. There would have been serious trouble last Sunday, without any doubt, on account of the large number of workingmen interested in the strike who would be idle on that day, if the company had not decided not to run any cars between Saturday night and Monday morning. There have been comparatively few cases of violence during the present week. Godfrey Van Dusen has been arrested on a charge of cutting feed wires on North avenue. He was up on the pole, it is said, when companians who were holding the ladder saw policemen and ran away. Van Dusen fell to the ground and was injured about the back so badly that he had to be taken to a hospital.

The company gained an important point when the city attorney decided that it was the duty of the board of public works to remove all obstructions placed upon the street railway tracks by sympathizers with the strikers. The duty of the city, it is held, is to keep the streets open to travel of all proper kinds. Now, instead of removing obstructions from the track itself, the company simply notifies the Board of Public Works, which in turn notifies the ward foreman. For the past few days there has been little blockading of track.

## Results Accomplished in Distribution of Light and Power by Alternating Currents.[1]

By W. L. R. EMMET.

The introduction of successful polyphase motors has constituted a very radical and important step in the development of the electrical art. The number of persons who realize the importance of this step is as yet small, and, like other new things, it cannot attain great successes until its merits and possibilities become more or less familiar to the public and to the practical business men, on whom the responsibilities for new developments must largely rest.

FIG. 6. POWER TRANSMISSION FROM LOWELL TO GRAND RAPIDS, MICH.—A GLIMPSE OF THE CROSS-COUNTRY LINE.

In the past, the use of alternating currents has been almost exclusively for incandescent lighting, and this narrow limitation has crippled the development of the art. While the applications of direct currents have called forth very large investments in plants and distributing systems, the uses of the alternating current have, as a rule, been on a much smaller scale, and the methods used have been developed rather with a view to reduction in first cost than to the attainment of the most economical results in operation.

The reasons for this somewhat half-hearted development may be stated as follows: First, the average efficiencies attained in most alternating plants have been very low; second, the distribution of potential obtainable with the ordinary methods has been imperfect; third, no reliable alternating arc lamps have been available; fourth, no practicable form of single-phase alternating current motor has, up to the present time, been introduced. At no time have all these difficulties been entirely unavoidable in alternating current distribution; they have, however, been fixed features of the system as it has in the past been installed by our manufacturing companies and used by electric light companies in this country; the state of the art being such that improvements were beyond the reach of most central station managers.

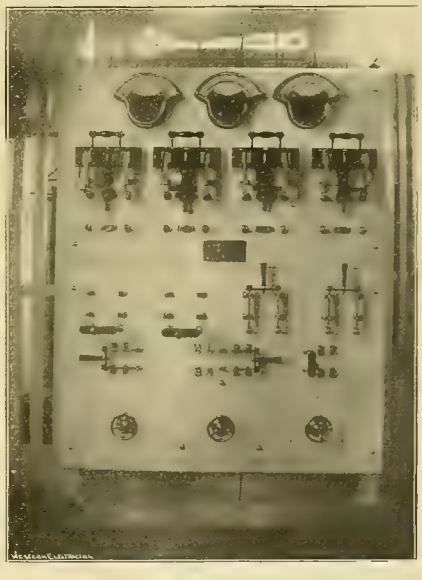


FIG. 5. POWER TRANSMISSION FROM LOWELL TO GRAND RAPIDS, MICH.—SWITCHBOARD IN STATION AT LOWELL.

In recent years great developments have been in progress in the branches of electrical science pertaining to

1. Read before the National Electric Light association, New York, May 6, 1896.

alternating currents; much new apparatus has been developed, plants have been installed on new lines, and practical results are to-day being accomplished that show that it is possible to overcome all of the objections which have been mentioned. We will briefly review in order some of the means by which the difficulties mentioned have been and can be avoided.

*Efficiency.*—The greatest losses in the average alternating plant are due to the waste in iron cores of transformers, which goes on whether the transformers are loaded or not. This waste can be reduced, either by the use of transformers of high light load efficiency, or by arrangements for cutting out transformers at light load.

Where primary distribution is used with large numbers of independent transformers, the extent to which these remedies can be adopted is very limited, since re-

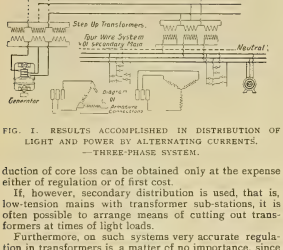



FIG. 1. RESULTS ACCOMPLISHED IN DISTRIBUTION OF LIGHT AND POWER BY ALTERNATING CURRENTS.
—THREE-PHASE SYSTEM.

duction of core loss can be obtained only at the expense either of regulation or of first cost.

If, however, secondary distribution is used, that is, low-tension mains with transformer sub-stations, it is often possible to arrange means of cutting out transformers at times of light loads.

Furthermore, on such systems very accurate regulation in transformers is a matter of no importance, since all transformers divide the load more or less evenly between them instead of operating from the same line at various conditions of load as in primary distribution. Thus, for this secondary work we can build special transformers having very small core losses and thus obtain very high all-day efficiency without impairment of regulation.

I have in mind a large plant now being equipped with alternating apparatus for lighting and power distribution on thoroughly modern and improved lines. In this case a system of three-wire low-tension mains is to be laid over a large area. These mains will be fed at street corners from specially designed transformers in ventilated manholes. These transformers are to be of 100 kilowatts each, and are to have a core loss of only 500 watts, or one-half of one per cent. of the capacity. The efficiency of these transformers at one-quarter load will be higher than at full load, the principal loss being in the copper. Thus a transformer may be made to fill the same function as a direct current feeder. If we are willing to introduce some drop between generator and main, we can get high light load efficiency with moderate cost, and we shall retain the important advantage that transmission is possible over long distances, with small losses, through the use of high voltage.

In no branch of electrical work has the improvement of recent years been more marked than in the manufacture of transformers. This improvement has not been brought about by any radical discovery as to the principles involved, but simply by study of the economic conditions. The quality of iron is a most important matter in building transformers, and the methods of handling and annealing are almost equally so. Then, the proportions by weight of iron and copper may be varied through a wide range, and the plan of arrangement of coils and iron is susceptible of endless variation. Every change of plan may affect the properties of the transformer as to self-induction, magnetizing current, hysteresis, eddy currents in core and copper, resistance loss and regulation. Thus there is much room for judgment in the design or purchase of transformers. At the price for which transformers can be bought it is folly to use bad ones. Thousands of transformers are in use to-day that are fit for nothing but the scrap pile and many are now being manufactured and sold that are no better.

*Regulation.*—The cause of bad regulation in most existing alternating plants is that each individual installation is connected to a separate transformer, and that in these transformers, and the wiring connected to them, there are losses varying with the load, which, of course, cannot be controlled from the station. Since regulation is a matter of most vital importance we see that with primary distribution good regulation in transformers is impera-tive. To make transformers of specially good regulation, something must be sacrificed, either in economy of first cost, or in light load efficiency, or in both. This there is always an appreciable drop through resistance of wire in transformers, and this, combined with the drop in primary and secondary wiring, gives rise to serious vibrations in pressure on lights at different points.

Another fruitful source of potential variations on alternating circuits is found in the self induction of circuits and also in the self induction of transformers. The electromotive forces introduced by self-induction, being out of phase with the current, are variable in their effect, and give rise to troubles that sometimes seem erratic, although in reality they are governed by well-defined laws, which, if properly observed, enable us to obtain accurate results.

*Motors.*—Until very recently the operation of motors from alternating systems has been practically out of the question, since no suitable motor has been obtainable. Thus alternating apparatus has been available only for lighting, while in direct current stations the motor load during the day has been a most important source of profit. It may be mentioned here that while incandescent lighting is at the present time meeting sharp competition from other forms of illumination, the electric motor is growing very rapidly in popularity. It has taken the public a long time to gain confidence in electric power and to realize its usefulness. It is only within very recent years that large manufacturers have begun to use electrical power distribution to any great extent. At present, this work is being carried on very actively, and highly successful and economical results are being obtained in many large mills. As a means of power distribution, even for short distances, electricity has no rival; while for lighting, its advantages, though great, are relatively much less positive.

Although for many years efficient electric motors have been in general use, there are many central stations in whose business power distribution has not been a very important factor. There are several causes which have tended to restrict the use of electric power, among which we may mention the following: Voltages that have been available for direct current work have not admitted of transmission to considerable distances. Motors have been a certain dynamo of attention, which users were sometimes unwilling to bestow. In certain classes of manufacture, the sparking of motors has been a source of danger. The most important cause, however, has been that, as a rule, the same apparatus has not been available for the operation of lights and motors; consequently, central stations have not been in a position to make attractive propositions to large users of power.

The introduction of good alternating current motors has opened a new era in electric power distribution,

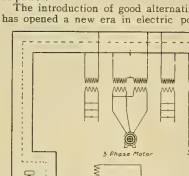



FIG. 2. RESULTS ACCOMPLISHED IN DISTRIBUTION OF LIGHT AND POWER BY ALTERNATING CURRENTS.
—MONOCYCLIC SYSTEM.

and seems to promise a great extension of its uses. With these motors the difficulties of distance are practically eliminated, since there is virtually no limit to the voltage which can be used. The mechanical features of the motor are near perfection, since it requires no care save what must be bestowed on its self-oiling bearings. These motors can be so arranged that they may be operated with perfect safety in any part of a powder mill or oil refinery, and, in fact, a number of them are being operated now in highly explosive atmospheres, where a spark would work destruction.

With facilities for electric power transmission thus improved we may look for great developments in the sale of power from central stations. When it is profitable for large manufacturing establishments to put in electric plants for the purpose of distributing power on their own premises, there should certainly be profit in the sale by electric companies of power to large as well as small manufacturers.

The actual saving in fuel effected in the operation of a large mill by electricity for power distribution is ordinarily very large; often as much as 50 per cent. With good equipment this is, however, only a small part of the saving effected by electrical distribution. The cost of coal seldom amounts to more than half the expense incident to the production of power, and in most cases it is a much smaller proportion of the total. If power is obtained from a central station, the coal is bought cheaper and used more economically, while other items of expense will in many cases be almost a clear saving.

The introduction on any large scale of electrical power distribution, of course, requires the investment of a good deal of money in new apparatus and plant. Power users are often slow to make these investments, because they are not familiar with electrical apparatus and do not realize the advantages to be gained. Repeated investigations have proved that users almost always far underestimate the cost of power. It is the business of the central station manager to correct these misconceptions, and to awaken interest in electrical methods. Of course, many companies are working zealously just on these lines. There is no question, however, that there is in many of our large cities a large amount of undeveloped power business. If electrical manufacturers can induce large millowners to put in plants for electrical power distribution, central stations should be able to sell power to similar concerns.

The following facts concerning sale of alternating power apparatus by one company alone will illustrate the hold which the modern improvements above mentioned have already taken upon the industry of the country: The first three-phase apparatus made in this country was put in operation two and a half years ago. Since then that company has put in operation 33,500 horse power capacity in three-phase generators; 10,000 horse power in three-phase induction motors; 14,800 horse power in monocyclic generators; 6,000 horse power in three-phase synchronous motors; 10,560 horse power in rotary converters, and 42,000 horse power in transformers used for power purposes; the average capacity of the latter being 26 horse power and the largest having a capacity of 1,100 horse power.

The production of this apparatus has involved the complete design and development of about 30 new forms of dynamos and 33 new forms of motors; each machine so developed involving the construction of new patterns and special tools, which, with drawings, etc., cost in the average about $1,000 for each new machine.

The development of so large a number of different machines has been made expedient by the engineering conditions that have been met. The matters of speed, frequency, voltage and capacity must all be considered in deciding upon the best apparatus for any given purpose; and, of course, it is, generally speaking, unwise to use anything unsuitable, even though it be of standard production and for that reason desirable. The expense involved in the production of all these machines is great, but it is in the long run money well invested, since it puts the manufacturers in a position where they can bid to advantage on the apparatus best suited to any case. It also brings a fund of experience that may be of more value than the tools, patterns and drawings.

The uses to which all this apparatus has been put are various. All sorts of new problems have presented themselves, and have been solved in widely different ways suited to the conditions. In many cases the apparatus built has been of types radically different from anything previously produced. In the past, the principal production of American electrical manufacturers has been from standard lines of apparatus, and we still endeavor to keep up this most economical and excellent practice. Since, however, we are now constantly called upon to produce special apparatus, we try to so standardize and systematize our methods that new work can be turned out promptly and economically, and without risk of failure.

The different methods of distributing power and light by alternating currents can best be illustrated by diagrams showing the connections with each. We will briefly review some of the applications of the systems now in general use.

Fig. 1 shows the three-phase system as ordinarily applied to the transmission of power for lighting and other purposes over long distances. The pressure may be of any convenient voltage, since step-up transformers are used. These transformers are in three units, or groups, any two of these units being available to transmit a large proportion of the power in case one is disabled. Two sets of step-down transformers are shown, one supplying 1,000-volt distributing lines, and the other supplying a system of four-wire secondary mains. With a given lamp voltage, such mains give a slightly better copper economy than the ordinary three-wire system, and afford an excellent means of secondary distribution.

Such a system as is illustrated in this cut, will give excellent service in almost any town, the low-tension mains taking care of the thickly built-up portion and carrying the bulk of the lighting load, while the high tension distributing system covers all outlying portions and operates large power units. A number of large plants

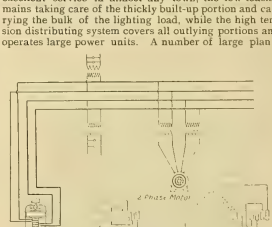



FIG 3. RESULTS ACCOMPLISHED IN DISTRIBUTION OF LIGHT AND POWER BY ALTERNATING CURRENTS.
—TWO-PHASE FOUR-WIRE SYSTEM.

have been installed within the last two years, using the three-phase system, as here shown.

Fig. 2 shows the connections for distribution by the monocyclic system. Here all lights are connected single-phase between a single pair of conductors leading from the generator, the motors being operated from the same single-phase circuit in combination with a third conductor leading from what is known as the teazer coil on the generator. Here the simple three-wire system is used for secondary distribution, and if it is desired to connect motors to the low-tension mains, a supplementary transformer is used, which supplies a secondary teaser wire, to this and the outside wires of the three-wire system the motors are connected.

The great merits of the monocyclic system are that the

number of conductors required for lighting and power distribution is reduced to a minimum, and that no unbalancing is possible. The operation of three-phase motors from this system is in all practical respects the same as when they are run from three phase circuits.

Fig. 3 shows the connections of the two phase system, with distribution by four conductors. Here the lighting is divided between two separate circuits, which must be kept balanced within certain limits, depending upon the regulation of the generator, or the amount of care that can be given to the adjustment of pressure on the different sides. Where motors are run, the two circuits must be brought together.

There is no economical and convenient way of operating secondary distribution from this system. Two independent three-wire systems could be operated, but these must be brought together when motors are to run. The complication of balancing such a system would be prohibitory.

The two-phase, four-wire system can be operated either from a generator with two independent circuits, or all four conductors can lead from one armature winding.

FIG. 4. RESULTS ACCOMPLISHED IN DISTRIBUTION OF LIGHT AND POWER BY ALTERNATING CURRENTS.—SINGLE-PHASE SYSTEM FROM TWO-PHASE DYNAMO.

Certain advantages may be claimed for both methods, and both have disadvantages.

Fig. 4 shows a method of single-phase lighting distribution from a two-phase dynamo. Here the two single-phase leads are taken out at points 180 degrees apart on a progressive armature winding. At points 90 degrees from those leads two other leads are brought out; each of the latter can be used with the pair of single-phase leads to run one-half the capacity of the machine in two-phase motors. These two power loads can not, however, be brought together.

The greatest disadvantage of this system is that when carrying a single-phase load a large proportion of the armature conductors are ineffective, and simply introduce useless resistance and self-induction in the circuit. Thus with the same loss the generator will deliver 42 per cent. more power as a quarter-phase machine than it will as a single-phase machine.

Fig. 5 illustrates the two-phase, three-wire system, which has been used to some extent both for high-tension distribution and for distribution by secondary mains. The principal advantage in this system is that it requires one less conductor than the four-wire, two-phase system. Its disadvantages are that the insulation of the apparatus is subjected to a voltage 42 per cent. higher than that which is available in transmission, and that the self-induction in the lines and transformers causes an unbalancing of the voltages on the two sides of the system, accompanied by the distortion of the phase variation. The extent of this unbalancing depends upon existing conditions, and is very different in different cases.

Fig. 6 shows diagrammatically the distribution of voltage with a given balanced load on a two-phase, four-wire circuit, and on the same circuit with one wire discarded, the third being used as a common return for the two sides of the system. $S\,F$ and $E\,G$ represent the two generated voltages on the four-wire, two-phase system. $F\,F'$ and $G\,G'$ represent the electromotive forces of self-induction in the lines of the separate two-wire branches of the circuit. $F'\,F''$, $G'\,G''$ represent the resistance drop in the two branches. $E\,F''$ and $E\,G''$, which are still at right angles, represent the two voltages at the end of the line.

The other diagram in Fig. 6 shows the condition on the three-wire circuit. $A\,B$ and $A\,C$ represent the generated voltages in quadrature. $C\,C'$ and $B\,B'$ represent the volts of self-induction in the outside conductors. $C'\,C''$ and $B'\,B''$ represent the volt's drop by resistance in these wires. $A\,D$ is the resistance drop in the third wire and $D\,D'$ is the electromotive force of self-induction in the third wire. Since this wire carries 40 per cent. more current than the others, $A\,D$ is 42 per cent. greater than $C'\,C''$, and $B'\,B''$ and $D\,D'$ bear the same proportion to $C\,C'$ and $B\,B'$. The lengths of $D'\,B''$ and $D'\,C''$ represent the voltages on the two sides of the system at the end of the line. The angle $C'\,D'\,B''$ is the phase relation of these two circuits and is less than 90 degrees. Thus with balanced load the sides of the system are neither equal nor in quadrature.

The figures are so proportioned as to represent a circuit of "No. 00" B. & S. wire, operated at 125 cycles with 10 per cent. resistance drop on the four-wire system, and the same load and the same distance with three wires. With 1,000 volts at the generator in both of these cases, we would have 850 volts on each side with the four-wire system, and with the three-wire system 730 volts on one side and 1,030 on the other. This assumes aerial lines with ordinary spacing of wires. In addition to the systems above described for distributing power by induction motors, we have other means of power distribution by alternating currents. The synchronous motor, for certain classes of work, is highly efficient and reliable, and is entensively used, although it will not fill all the requirements of general power distribution.

The rotary converter also fills a very important place in the engineering work of the day.

A synchronous motor is simply an alternating dynamo whose functions are reversed. They may be used either on single-phase or polyphase circuits. In its simple form, a synchronous motor has no power of starting itself on a single-phase circuit. On a polyphase circuit it starts with more or less torque as an induction motor, and will come to synchronism. As a rule, however, the starting of synchronous motors is not vigorous, and is accomplished by a large draught of current; hence their applications are limited.

A rotary converter is a synchronous motor of suitable construction, whose armature windings, besides being connected to collector rings, are also connected to a commutator. As the machine revolves at synchronous speed, brushes collect direct current from the commutator, this current being partly rectified and partly generated by the machine. This machine deals in direct and alternating currents and mechanical power; supply it with any one of the three, it will deliver either one or both of the others. It is most efficient when filling its functions as a converter from alternating to direct currents. Its capacity is then greater and its efficiency higher than when it runs as a generator or as a motor.

To illustrate the use of the rotary converter, I will describe an application now under consideration. The company in question is operating three stations—one of these is very large and centrally situated, with condensing water and every facility for the cheap generation of current. Each of the other stations is about two miles from the main station; both work non-condensing. One of these stations delivers current only on the direct current, three-wire system, while the other, in addition to similar work, carries a considerable arc-light load. In this case the following plan is considered:

At the two smaller stations rotary converters would be installed, and would deliver only direct current in one case, while in the other they would also act as motors to operate arc machines through a countershaft, to which they would be belted with clutch pulleys. Suitable step-down transformers would connect the rotary converters to a high-tension line leading to the main station. At the same station three-phase generators of large capacity would be installed. These generators would be designed to deliver both three-phase alternating currents to step-up transformers, and also direct currents at about 250 volts to the outside conductors of the three-wire system. They would be directly coupled to engines. These machines would deliver current simultaneously, in any proportion, to the direct-current, three-wire system, to the rotary converter, or to lines distributing three-phase power.

It is proposed to operate these machines at a frequency of 25 cycles per second, this being well adapted to the direct current work and also to three-phase power distribution.

In this plant an entirely independent control of direct-current pressure within a wide range would be necessary at the main and sub-stations. This would be effected without the introduction of idle currents, by the use of a novel form of three-phase induction regulator connected to the alternating leads of each rotary converter. These regulators would give a wide range of

FIG. 5. RESULTS ACCOMPLISHED IN DISTRIBUTION OF LIGHT AND POWER BY ALTERNATING CURRENTS.—TWO-PHASE THREE-WIRE SYSTEM.

adjustment without any moving connections, and would greatly simplify the operation of the plant, and also increase its economy, since the losses introduced by the regulators themselves are very small, and since conditions of general economy are always maintained. Thus a single engine could carry the whole load of the city at certain times.

Another interesting illustration of a combination of alternating and direct currents is found in a case now under consideration. A company controls about 3,000 horse power in water at a distance of 11 miles from a large town. It is proposed to install three-phase, 60 cycle generators in 600 kilowatt units. The current from these generators will be transformed to 10,000 volts and carried over three wires to a city sub-station centrally placed. Here large step-down transformers will be installed, delivering current to 2,000 volt lines, which extend all over the city and carry motors and lights in outlying parts.

In the same station two large Corliss engines are now in operation, and are belted to clutch pulleys on a countershaft, which operates some arc machines and other load. To this same countershaft it is proposed to couple with a clutch a large synchronous motor which will be connected to the 2,000 volt lines. When the water supply is ample, the engines will be shut down and the motor will run the shaft. When the water is low, or more power is required, the engines will be run and the synchronous motor will then act as a generator, running in parallel with the transmission line.

In the central part of the town it is proposed to install a system of three wire mains and a large storage battery. This battery would be installed in a second sub-station, conveniently placed. It would be charged from a pair of direct current machines, directly coupled to a synchronous motor operating from the 2,000 volt lines. The direct current machines would be used in connection with the batteries for supplying the three-wire system. The plan here outlined has many very positive advantages.

The pressure on the 2,000 volt system can, within certain limits, be controlled at the sub-station by adjustments of the field of the synchronous motor. With telephone communication to the power house, the control will be perfectly easy. The peak of the lighting load being borne by the battery, the generators can be loaded nearly to their full capacity with motors during the day.

FIG. 6. RESULTS ACCOMPLISHED IN DISTRIBUTION OF LIGHT AND POWER BY ALTERNATING CURRENTS.

At night they will charge batteries, using water which would otherwise run to waste.

In both the plants described the cost of labor would be very small, one man being enough to operate each of the sub-stations mentioned. The saving of labor in operation should be kept constantly in view in all engineering plans. Some of the greatest advantages in modern apparatus lie in its adaptability to such saving.

An infinite variety of conditions exists in different cities and the question of electrical distribution must be carefully studied in each case, in order that money may be invested to the best advantage. An intimate knowledge, both of the apparatus available and of the commercial conditions, is necessary to an intelligent decision in such cases. It is only through the exercise of intelligence and judgment of a high order that the best results can be obtained.

### Discussion.

Mr. Wagner: I understood Mr. Emmet to say the three-wire two-phase machine, when operating three wires in place of four, would have 42 per cent. less capacity for lighting.

Mr. Emmet: I said when operating single-phase instead of two-phase.

Mr. Wagner: Such a machine should have, when operated two-phase, 42 per cent. greater capacity than when operated single-phase; but it seems to me that when compared with an ordinary single-phase machine, or with the monocyclic machine, it would have the same capacity for the same dimensions, and that the increase of capacity for two-phase operations would simply be at the expense of a small amount of copper in addition, so that such a machine, compared with a single-phase machine, or with the monocyclic machine, should have practically the same capacity when operating on the single-phase system in connection with a three-wire two-phase.

Mr. Emmet: I will draw a diagram to illustrate the matter. [Mr. Emmet proceeded to sketch his idea, explaining as he proceeded. He drew an armature with a distributed winding all the way around, indicating the poles, and showed where if it were used as two-phase the connections would be made, and then pointed out the changes that would be required if it were wound for single-phase currents alone, without any reference to two-phase use.] By making the machine single-phase we could increase its capacity without changing its proportions. But using the distributed wound machine as a single-phase machine we are using turns on the armature which are unnecessary; that is, we are sending current through wire that is doing no good. These turns have self-induction and resistance, and it is not working in its most effective way. It is not the best form of machine for single-phase use, and if used as a quarter-phase machine, it will be working much more effectively. Of course, any polyphase machine can be given a greater capacity for the same amount of material used than a single-phase machine, but to make a quarter-phase machine, and use it as a single-phase machine, increases the advantage; that is, it militates against the single-phase operation of the machine, and monocyclic machines are built as single-phasers. They are built with wire not distributed all over the armature, but placed where it will do the most good, and the rest of the armature is left empty.

Mr. Wagner: Such winding as represented there (in Mr. Emmet's diagrams), with the same dimension of machine for the same capacity as the monocyclic, would have 20 per cent. more copper on the armature and would have the disadvantage of the additional self-induction and resistance of that copper when operating single-

[Continued on page 260.]

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**SUBSCRIPTION**, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

**ADVERTISING.** —THE WESTERN ELECTRICIAN — **the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

**HIGH WATER MARK**
**CIRCULATION, 16,630.**

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THE publication offices of the WESTERN ELECTRICIAN have been removed to much more commodious quarters. Our new address is Suite 510 Marquette building, Dearborn and Adams streets, Chicago.

The telephone number remains unchanged—Main 1746.

THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687, and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention.

| Issue. | Number of Advertising Pages. | Total Number of Pages. | Square Inches of Paid Advertising Matter. |
|---|---|---|---|
| March 3, 1894 | 40 | 56 | 1,145 |
| February 23, 1895 | 52 | 68 | 5,593 |
| May 9, 1896 | 72 | 88 | 7,576 |

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

NEW YORKERS have very serious doubts on the subject of securing real rapid transit through such a slow-going agency as the present Rapid Transit Commission.

MANY years' experience entitles L. H. Rogers to speak with authority on the subject of arc lamps, and we have no doubt that the views expressed by him in his paper before the National Electric Light association at the New York convention will receive respectful consideration. The first installment of this paper is presented elsewhere in this issue. It made a favorable impression on central station men, many of whom had experienced the annoyances to which Mr. Rogers referred. It is evident that arc lamp makers recognize the necessity of conforming to present-day ideas and are striving to perfect their lamps and improve their appearance. There has been considerable advancement of late and more is promised in the near future. Mr. Rogers' paper should stimulate the efforts of those who are working in this line. There is much room for improvement.

SIX men were injured in an accident in one of the Chicago water tunnels under the lake last Saturday. An explosion that resulted from the contact of natural gas and the flame of the miner's lamps used by workmen seriously burned three men and injured three others. A workman's pick had penetrated a mammoth gas chamber, far out under the lake, and the released gas caught fire from the lamps that had been stuck in the walls, when a sheet of flame was sent to the end of the tunnel, 1,200 feet away. Several of the men were knocked senseless by the force of the explosion, and in the darkness that followed the panic was frightful. In these days it seems strange that precautions are not taken that will avert such accidents. Contractors should be compelled to use incandescent lamps in tunnel work and provide workmen with incandescent lamps for miners.

CHICAGO will honor the memory of Franklin next month when a statue of the celebrated American will be unveiled at Lincoln Park. The occasion will be marked by appropriate public exercises and the ceremony will be of a character befitting the event. Dr. Franklin was one of the great men of history, and each year we are learning to appreciate him and his works at more nearly their proper value. Dr. Depew, in his speech at the electrical exposition at New York last Saturday evening, said: "The most practical philosopher who ever lived was Benjamin Franklin. Theory and discovery were worthless, in his judgment, unless they could be utilized for some beneficial purpose." His whole life was spent in the advancement of public interests. Mr. Medill, who will present the statue to be placed in Lincoln Park, is doing a great public service, as his gift will serve as a constant reminder to the present generation of the life and work of the great patriot, statesman and scientist of the revolution.

IT is evident that the Chicago street railway companies recognize the importance of the movement for a reduction of the rate of fare charged upon their lines and the bearing of the recent decision of the Appellate Court upon this subject. Heretofore, street railway ordinances passed by the Chicago City Council have contained a provision that "the rate of fare shall not exceed five cents," the language being adopted probably because it was used in the early charters which the Legislature granted the companies. It has been claimed that this provision permitted of the construction that the council reserved the right to reduce the rate of fare whenever it should see fit to do so. The railway companies, while refusing to recognize the legality of such proceedings, have taken the precaution to have the wording of the provision regarding the rate of fare changed in the latest ordinances introduced in the council so as to meet the changed conditions, as will be seen by the following section taken from an ordinance now pending: "The rate of fare to be charged upon the line of railway herein authorized shall be five cents for one continuous ride either way." The attitude of the council toward the street railway corporations will be determined by its action upon the ordinance containing this radical innovation.

MUCH value attaches to the meetings of the National Electric Light association because of the opportunities they present for securing a discussion of the needs of the central stations and the efforts of manufacturing company's to meet these requirements. The general interests of the industry are thus greatly advanced. An excellent illustration of this point was presented at the New York meeting, when an important problem in central station management, the distribution of light and power by alternating currents, was considered by W. L. R. Emmet in his paper, which is reproduced elsewhere in this issue together with an interesting and instructive discussion which was participated in by several prominent experts. Several applications of the systems now employed were described and illustrated, and the characteristic features of each explained. Mr. Emmet also referred to proposed applications and indicated in a general way the line of development of this problem that will occupy engineers and designers in the immediate future. The importance of the subject will at once appeal to central station men, and while local conditions may require considerable modification of the plans presented, there is no doubt that the advantages to be derived from them will make the general plan attractive. In the discussion which accompanies this paper the views of some prominent central station men and engineers an given on present-day practice. Altogether it is a most valuable addition to the literature of the subject.

PUBLIC documents containing statistical information have little interest for the masses of the people, generally speaking, but occasionally one is presented that is an exception to the rule. This is the case of the report of the patent commissioner. It is a record of progress, education and development. "As a function of government the patent system is wholly unique," says the commissioner. "It cannot be compared with a system of public education, wherein the government undertakes to promote the general well-being by educating the individual. It is wholly unlike the pension system, which seeks to reward past sacrifices. It is a new feature of the modern world, and its laws and instrumentalities have rapidly developed into a vast system. Its past and present are imposing; its results are far-reaching and beneficent; its future is full of promise. It is a satisfaction to note that the American patent system is generally conceded to be the most perfect in the world." And it might be added that it has proved conclusively that Americans are the greatest inventors of the world. In the last quarter of a century 25 inventors have been granted more than 100 patents each by the United States, the total number issued to these in that period being 4,894. The statistics presented on this subject are of special interest to the electrical fraternity, as the period mentioned is the one that has seen the greatest activity in electrical invention, and in the list presented there are many names familiar in electrical circles. Thomas A. Edison has been granted 711 patents during the last 25 years, which beats the record for all times and all countries by a large majority. Elihu Thomson stands next on the list with 394, Francis H. Richards, who is a mechanical rather than an electrical inventor, is third with 343, Edward Weston, 274; Charles E. Scribner, 248; Charles J. Van Depoele, 244; Randolph M. Hunter, 228; George Westinghouse, Jr., 217; Rudolf Eickemeyer, 158; Hiram S. Maxim, 131; Sidney H. Short, 111. This is certainly an excellent showing for the bright minds of the electrical industry, and one that any department might well be proud of. Enumerating the classes in which there has been special activity in the last year, the report says: "There has recently been great activity in inventions in telephones, due, as is supposed, to the expiration of pioneer patents, and not a litttle in electric locks, a new art. Alternating current motors and other machines employing the alternating current have latterly been the subject-matter of increased inventive thought." That portion of the report dealing with electrical invention is particularly valuable, as it contains a brief sketch of the development of the art as traced in the patent records. There is one general suggestion in the report that should receive immediate attention. It is the appeal of the commissioner for facilities for collecting and preserving models of apparatus patented. This matter has been too long neglected. It should receive consideration at once.

## Great Feat in Telegraphy at the Electrical Exposition.

Much attention has been attracted by the feats in long-distance telegraphy accomplished on the evening of May 16th at the electrical exposition in New York, during the delivery of an address by Chauncey M. Depew on the general subject of electrical advancement. To demonstrate the promptness of modern telegraphic science, messages written by Mr. Depew and by Edward D. Adams, president of the Cataract General Electric company, were transmitted nearly simultaneously by the Western Union and the Postal companies on circuits estimated at 27,500 miles each, from New York through several continents and returning to New York. Mr Depew's message was addressed to Mr. Adams, because that portion of the Postal company's circuit between New York and Buffalo was energized with electricity generated by Niagara Falls. Mr. Depew's message was in these words:

God created, Nature treasures and science utilizes electrical power for the grandeur of nations and the peace of the world.

Mr. Adams was more specific:

Mighty Niagara, Nature's wonder, serving man through the world's electric circuit, proclaims to all peoples science triumphant and the benevolent Creator.

Col. Albert B. Chandler, president and general manager of the Postal Telegraph company, acted as the sending operator on the lines of his company for Mr. Depew's message. The circuit on which he transmitted the message was made up via Chicago, Los Angeles, San Francisco, Vancouver, Winnipeg and Canso, thence to London and back via Boston to New York. President Chandler was stationed in the north balcony of the exposition hall. He started the message on its long journey at 8:34 o'clock. The receiving operator was Thomas A. Edison. He was stationed in the south balcony, and handed Mr. Adams a beautifully written copy of the message at 8:38, four minutes after Mr. Chandler had transmitted it. When the message reached London a copy was handed to the Eastern Telegraph company and was forwarded by it over various lines and cables via Lisbon, Gibraltar, Malta, Alexandria, Suez, Aden, Bombay, Madras, Singapore, Hong Kong, Shanghai and Nagasaki to Tokio, Japan, returning thence via London, and reaching the exposition hall at 9:24. The distance traveled was 15,000 miles. The instruments used were of the latest Postal pattern, with aluminum levers. They are handsomely mounted on an ebony base, and will be presented to the Smithsonian Institution in Washington, together with attested records as to the time occupied in transmitting the message and copies of every newspaper in the world in which the occasion may be noticed. These will be carefully preserved by the Smithsonian Institution as evidence to future generations of the advanced state of electrical science in this year of 1896.

Charles A. Tinker, general superintendent of the Western Union company, acted as sending operator for his company. The receiver was Superintendent L. C. Baker of St. Louis. This company made up a circuit between New York and Galveston of about 10,000 miles. Mr Adams' message went via Chicago, San Francisco, Los Angeles and St, Louis. At Galveston the message was given to the Mexican Telegraph company and the Central & South American Telegraph company, which transmitted it about 6,500 miles by way of Mexico, San Juan, Nicaragua, St. Elema, Equador, Chorillis, Peru, to Valparaiso, Chile. Thence it went by land line over the Andes Mountains to Buenos Ayres, where it was put on the cables of the River Plata, the Western & Brazilian and the Brazilian Submarine Telegraph companies, and sent about 6,000 miles, via Rio de Janeiro, Pernambuco, St. Vincent, to Lisbon From Lisbon it went over the cables of the Eastern company, about 1,000 miles, to Penzance, England. Thence it came over the Western Union Atlantic cables via Canso to New York, about 4,000 miles. The total circuit over which the message traveled was therefore 27,500 miles in length, practically circling the Western hemisphere, but crossing the Atlantic and touching Europe on its return. The answer was received over the Western Union circuit 21½ minutes after it started on its journey of 27,500 miles. The land line was 7,387 miles in length, the longest circuit ever worked in the history of Morse telegraphy. The time occupied by a single letter in traveling over this land line was, as closely as could be timed, three seconds.

PARTRICK & CARTER COMPANY'S BOOTH AT THE ELECTRICAL EXPOSITION.

In his oration Mr. Depew said:

This exposition illustrates another beneficent advance in electrical development. It suggests an opportunity of escape from territorial limitations of coal and the prohibitive cost of transportation. Wherever there are mountains and lakes there is water power. That this power can generate electricity has been known, but its usefulness has been handicapped because the mill and factory could not be readily transported. The most sublime concentration of continuing force in the world is Niagara Falls. We are here, 450 miles from Niagara, and witnessing that the power generated there can be transmitted here. It is a demonstration of incalculable value. It will redeem the waste places of the world. The tumbling torrent will come to be the treasure house of nations. Wherever water flows electrical power may be generated which, transmitted great distances, will create the mill, the factory and the furnace, and give that employment to capital and labor which relieves the farmhouse of its surplus of boys and girls and gives the farm the profitable market in a neighboring seat of population and industry.

HEADQUARTERS OF "WESTERN ELECTRICIAN" AT THE ELECTRICAL EXPOSITION.

## Notes from the Exposition.

The official ticket agent of the exposition has no sinecure, and few could fill the position with more satisfaction to all than Hugh Harrison, who, in meeting the demands made upon him, has shown a genial courtesy and fairness which will leave a pleasant memory.

Secretary Geo. F. Porter of the National Electric Light association is not taking a rest after the adjournment of the convention, but is executing the duties pertaining to his position with the exposition company, to the success of which he has very largely contributed.

The Iron-clad Rheostat company of Westfield, N. J., engaged 100 feet of space at the exposition (B 28), but was so pushed with business that it was unable to make an exhibit. This was, of course, unfortunate in one sense, but gratifying as showing the dull-time success of this prosperous concern.

The attendance at the exposition in New York during the week has been very satisfactory. During the evenings the building has been, at times, uncomfortably thronged. There seems to be an increasing interest among the general public. It is believed that the admissions have thus far averaged 5,000 per day.

General Sales Agent J. A. Russell of the Western Telephone Construction company of Chicago has arrived in New York to take charge of this company's exhibit at the exposition. The tasteful arrangement of the exhibit receives many compliments, and it is reported that the company is doing a good business.

To many the most attractive souvenir of the exposition is a little novelty distributed by the enterprising Standard Underground Cable company. It is entitled "A Reminder of Ohm's Law," and is certainly an original and novel arrangement of a law that cannot be too much impressed on the minds of electrical men. This device

will be sent upon request by addressing the Standard Underground Cable company at New York, Pittsburg or Chicago.

There are very few exhibits at the exposition that contain so many features of interest to practical men in all lines of electrical work as that of the Fartrick & Carter company of Philadelphia. It is complete and comprehensive and is well arranged. T. L. Townsend is in charge, and he is kept busy explaining the numerous novelties his company handles. A view of the exhibit is presented on page 259.

The headquarters of the WESTERN ELECTRICIAN is one of the most attractive booths at the exposition. It is known as C 48-49 in the official allotment of space. Western visitors have made this booth their headquarters, and naturally enough representatives of eastern houses have found it an excellent place to meet the men from this district. An excellent picture of the booth is presented on page 259.

The successful arrangement of the various booths and exhibits at the exposition and the comparative absence of complaint reflect great credit upon Superintendent Marcus Nathan, who was given full charge of all affairs pertaining to the locating of exhibits and the various details of the exhibition about 10 days before it opened. The executive ability shown by Mr. Nathan has contributed very largely to the success of the electrical show in New York.

It was fortunate that the Exposition company was able to secure the services of Luther Stieringer to take charge of the display features. His long experience with expositions and well-known ability to handle matters of this kind in the most efficient manner are seen in the arrangement of the Röntgen ray and Edison fluoroscope exhibit. This portion of the display is visited by hundreds of people, and every arrangement is made for the very best showing of the scientific experiments.

The firing of the signal guns at San Francisco, St. Paul, New Orleans, and Augusta, Me., was the idea of A. A. Knudson of New York, who submitted the plan showing how this could be accomplished to the Postal Telegraph company. Mr. Knudson's previous experience in such matters at different expositions proved of great help to the officers of the exposition. It is understood that a number of other plans which he has suggested may be utilized before the termination of the exposition.

## Results Accomplished in Distribution of Light and Power by Alternating Currents.

[*Continued from page 257.*]

phase, but would have nearly the same properties for operating such motors monocyclic.

MR. EMMET: It would have somewhat different properties from the monocyclic, but good properties for operating motors. Of course, these questions of the design of the machine depend altogether upon what regulation and armature reaction you want. In a machine with small armature reaction, it makes less difference whether you have a little idle wire on the armature or not, such armature losses are small. It is not economical to run too small armature reactions, as you increase the cost of the machine. It is desirable to use fairly large armature reactions in most cases where it can be done without trouble and with proper regulation.

MR. AYER: Mr. Emmet states in his paper that he has in mind a construction consistent with transformer sub-stations of secondary feeders located at intervals. We know that is done abroad considerably, and I think it is done in your station in Chicago, Mr. President?

MR. WILMERDING: Yes, sir.

MR. AYER: It is interesting to know that we are getting successful results with these things and that their apparent practicability has been demonstrated.

MR. VAN TROMP: I am operating a two-phase system synchronously, driving Edison generators on the three-wire system, and the system works beautifully, with one exception, which I am unable to explain at the present time. With perfectly steady and even load on the Edison generators and no fluctuations whatever in the speed of the prime movers, there appears to be a slight fluctuation on the alternating current mains, as though the motors tended to get out of synchronism. They do not pull out of step. I should think it was due to a difference in the curve of the generator and the motor.

MR. EMMET: It is probably due to variation in the speed of the prime mover. The synchronous motor has no mechanical connection with the moving system, and yet it has to keep in synchronism. It is simply held by the current in the line. As your synchronous motor tends to get out of step it varies the voltage on the line considerably. It causes a distortion of the voltage, and might cause a rise or fall of the voltage. It becomes a trailing or lagging current according to its position. A tendency of the prime mover to vary speed would create a tendency to pull apart; every time the generator carried the load but in speed, it would tend to pull out, and in doing so would cause a variation in the voltage and that might take almost any form of vibration. It might depend upon the watts of the moving system. The only remedy is in an absolutely uniform speed of your generator.

MR. DU CROW: I remember when the alternating system first came into use for central station lighting, one difficulty that confronted users was the running of lights and power on the same circuit. Another was the question of the transformer, the first cost and the number to be used. It was said at the time that the multiplication of transformers was unnecessary, and the idea developed that we would have only one large transformer for feeding a large number of installations, which seemed very reasonable and plausible. At the next meeting of this association the sentiment prevailed that under the extraordinarily varying conditions and loads of a large number of installations distributed from one transformer, the losses in that large transformer at a light load more than counterbalanced the losses in the greater number of transformers under the original idea of this method of transmission.

MR. SCOTT: Large transformers for supplying a number of customers will in general be more economical in the amount of power required for operation and also in the first cost, over the usual plan of supplying each customer by an individual transformer. The capacity of the large transformer may be less than the aggregate capacity of the small transformers which will be required. The cost of secondary mains may be prohibitive, however, if the district is a very large one, or if the service is underground and the cost of individual connections is high. If the mains must go underground it would be just as necessary to run the primaries underground with the house connections of the primary mains, which would be more expensive than the secondary mains. This question is one which depends largely on the conditions. In general, I believe in the use of the secondary mains, and believe this will be found the most economical.

In a discussion of the three-phase and two-phase systems of distribution, one of the points which confronts the customer is the measurement of the power on the two systems, both commercially for the sale of power and also for the determination of the loads on the system; the measurement of current in different branches or the measurement of power in different branches. The three-phase system is so inter-connected that without elaborate or extended measurements or calculations, the total power, whether it consists of load on the three circuits, what the relative load is, whereas on the two-phase system, where the circuits are independent in action, except to a very slight extent, the measurement of what goes on in one circuit—the measurement of the current in one circuit—would indicate the amount of current supplied to the devices connected with that circuit. In general, the amount of power measured directly in the circuit, added to the amount of power measured directly in the other circuit, will give the total power. If the conditions are a little abnormal, or something is wrong, the very time when the ordinary operator wants especially to know where the trouble lies, the two-phase system, with independent circuits, seems to me the best arrangement; and I know in some cases in practice has given much less trouble than the three-phase system does.

A method of secondary distribution which has not been widely used, but is being introduced, and it seems to me has a great future before it, is the three-wire system, with a modification in which only two-wires are run from the central station, or in which only two secondary mains may be required instead of three, which reduces the number of house connections required. In this case the neutral might be used as a secondary mains and two connections made to a customer. On the customer's premises a balancing coil, in the form of a converter, with a single winding, adapted for 200 volts, the two ends of the winding being connected to each circuit, and a loop brought out from the middle of the coil, from which point 100 volts may be measured to either of the secondary mains, could be used for the connection of the middle or neutral wire. This coil would preserve a balance between the two circuits so that should the number of lamps be greater on one circuit than the other, the electromotive force would be practically balanced. This simplifies the three-wire system. The loss in balancing coils is very small. The balancing coil is a form of converter which will give a very large output, and its capacity need be only that required for the difference in the number of lamps on the two circuits; say there are 25 lamps on one circuit and 75 lamps on the other circuit, the capacity of the coil would be 50 amperes, whereas the total number of lamps on the circuit would be 100. The size of the coil required for this difference in lamps would be the same as would be required for only 25 lamps, if there were ordinary loads on the two-wire system, so that the cost of these secondary balancing coils need only be quite small.

The system of two-phase distribution shown in Fig. 4 in which the generator is wound with closed circuit and the terminals brought out at either four points, two being used for a single-phase lighting, and one of the other leads being used in connection with motor work, requires the use of but three wires to any point where motors are required. The use of four wires here is usual in many cases for motors, if the power required by the motors be large. The effective potential of distribution for motors is about 700 volts upon each of the two leads, instead of the lighting by 200 volts, and the motor be run from three wires, but if all four wires are used, then the effective potential for motor service is 1,000 volts in the transmission line on each of the two circuits. Thus, if the quantity of power to be delivered by the motors is considerable, the use of four wires may lead to a saving in the cost of conductors, making it well worth while to run them. This kind of generator admits of this connection very readily. The only disadvantage of this system that has been pointed out, but is said to be the greatest one, is the reduced capacity of the generator. That point has already been discussed. It is usually satisfactory to the customer to know that he can buy a dynamo for a certain price to do single-phase work, regardless of what the dynamo may do if operated in some other way.

The supplying of motors from a dynamo of this kind by three wires involves the two-phase, three-wire system, in connection with which the unbalancing of the two circuits has been pointed out. This unbalancing will tend to unbalance the motor circuits, raising one and lowering the other. This system is best adapted for a large percentage of lighting load, with a motor load as an auxiliary, as is the case in general station practice. In that kind of service the unbalancing of the two circuits does not affect the lighting part where closeness of electromotive force is required, but affects only the motor work, where the electromotive force is not required to be adjusted with the same nicety. With a motor load the unbalancing is not quite as great as it is on lighting loads, due to this mutual induction between the two circuits. The effect of the unbalancing in the example in the paper is extreme, and results largely from the high frequency of 125 cycles. At low frequencies the effect would be very greatly lessened.

I desire to reinforce what is said in the latter part of the paper about the flexibility of the alternating system coming into actual practice. You have heard about the flexibility of this system for a long time; its adaptability to all kinds of service has been pointed out. The latter part of the paper shows how that is being done now on a large scale, and the Hartford, Conn., plant is one that has come to my attention lately. One machine may act as a generator, driven by an engine supplying power to the city, or it may be run as a generator in multiple with machines at two different stations 10 miles away, or may be run as a synchronous motor for replacing the engine. The running of this current through rotary transformers, for supplying storage batteries, is also an application which ought to be adopted elsewhere.

MR. DOW: I began to use large tranformers for 150 and 250 lights in 1889, with entire satisfaction, and found that the very best results could be had; the economy being in first cost, for the fact that a block where 500 lights were scattered in stores and offices could be served by 250 light transformers, with a reduction of the iron losses. I have had no reason since 1889 to change my mind, and the practice is now to put in the largest transformers we have up to 1,000 lights, where they are equal as to cost, and a little against the secondary main, I have found the transformer preferable.

As to the two-phase, three-wire system, I can say from practice that where a large building is wired with the Edison three-wire system, and the neutral is usually of the same size as the two outer wires, in almost every case that system can be used without interference or objection at all from induction or any other trouble. In these cases to my knowledge, in buildings with 600 or 800 lights, we have the Edison three-wire system and the users did not know the difference. The essential point is that they are not so apt to create a drop in the building. The case is given where the building is wired with the neutral; it is the same size as the outer wires. That method is entirely acceptable, and can be used every time.

I wish to ask, Is there nothing better for series arc light circuits, in connection with the alternating station, than the running of the well-known series dynamo by a motor? Is there no prospect of series alternating arcs, such as might be used for street lighting, assisted by a rectifier system such as is used in England, outside of what is now available up to 4,000 volts in light circuits?

MR. WAGNER: Mr. Emmet referred to a synchronous motor used to drive counter-shafting, which in turn operates arc light generators. That would hardly be an economic method unless it was possible to operate the arc light machines directly from the station, where steam power could be directly applied. Arc lights can now be operated satisfactorily directly from the alternating current circuits, either using a transformer for each arc lamp or a transformer for a number of arc lamps.

MR. AYER: How many lamps a single transformer, and by what method of distribution?

MR. WAGNER: I am experimenting in this line of operating a large number of arc lamps for street lighting from alternating current circuits. The system used is one which admits of the use of the ordinary circuits, such as are used for series arc lighting, and with the lamps placed in somewhat the same way. As many lamps as desirable can be operated, I was going to say, but that is limited by the voltage. I am now operating as many as 75 lamps on one transformer, and that does not seem to be the limit of the number that can be operated. The system has not been in operation long enough to determine positively its success, and, therefore, I am not prepared to furnish all the details. I hope to be able to do so before long; and if it is a success it will be a very economical way of operating arc lamps in connection with incandescent lighting by means of alternating current. Arc lighting, incandescent lighting and power can then be furnished from the same generator.

It has been found possible to design transformers for use with a proper system of secondary distribution, so that the efficiency of each transformer shall not fall below 94 per cent with the smallest load which is likely to be operated over it. Such transformers are made in large units, preferably of the same capacity as feeder units and placed at the ends of feeders, the entire system of distributing mains to be at low potential and operated by means of transformers placed at the feeder ends. The regulation of the transformer can then be considered as part of the feeder regulation, and, therefore, is not limited by the ordinary limits of possible variation on incandescent lamps; and with a possibility of a little poorer regulation, greater drop in the trans-

former, it is practicable to so reduce the iron core losses in the transformer that the efficiency will actually be higher at a quarter, or even less load, than at full load, and the average efficiency will be about 95 per cent. Such transformers have been designed, and there seems to be no difficulty in their use; and the combination in that way of the best direct current practice with the alternating current system seems to provide an extremely flexible and extremely economical general distribution by alternating currents for large cities, by which power, incandescent lights and arc lights can be operated from the same set of secondary low potential mains.

MR. DOW. This year series alternating arc lamps do

WILLIAMS & ABBOTT'S NEW MAGNETO BELL.

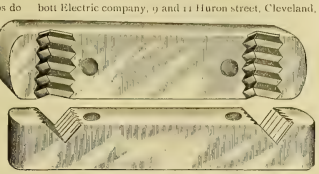
work and can be made to work, and alternating lamps can be had which apparently will make just as little trouble as the old line direct lamps. Last year I should have had to say that there was no alternating lamp that could be relied upon and stay in the service as long and without complaint as the old style of lamp.

I can throw a little light on the problem concerning rectifiers from recent correspondence with English engineers. The rectifier has been in use in England for four years all told. It began with a 20 light size and has got up to a 60 light size, and there seems to be nothing to prevent its development beyond that limit except the conservatism of English engineers, who think that 3,000 volts is pretty near the jumping-off place. The efficiency of the device in connection with a first-class alternator, and in its development, is identically the same efficiency that I am getting in my own practice with 50 kilowatt 110 volt arc light machine. The efficiency is 73 per cent. from the indicated horse power, through the mains to the output, in kilowatts. The output is not in a pulsating current, such as might be had with a rotating coil armature, with a two-part commutator. The light is to all intents and purposes a direct current arc, and not the alternating current arc. A series transformer and regulating device gives the same characteristics in the light as arc light dynamos in use in the United States. They have considerable self-regulation. The limiting voltage, as I say, in practice is 3,000 volts. The limitations appear to be in the commutator. On this side we have succeeded in making commutators operating with 6,000 volts. I do not see why a motor synchronously driven should not operate just as well the commutator on a dynamo shaft. I cannot see that there is any difference between the open coil commutator of the well-known types and the rectifier commutator driven by a synchronous motor. The two devices appear to be the same. I look for something in that line and hope to see that same rectifier taken up by some American engineer and experimented with in alternating transmission over long distances.

The efficiencies I am now getting, I believe, are as good as the average for public lighting, 85 per cent. losses in the lines. The lines when fully loaded are more economical, and give 75 per cent. I believe that is better than the average, and may be considered as a first-class representation of a modern station of that class. I doubt if an alternating system distribution through transformers, or an alternating current will succeed in increasing that efficiency, and I am afraid that high voltages, 5,000 or 6,000 volts, will be essential in public lighting, as long as the city fathers consider it necessary to have lights in sparsely settled outlying wards.

## Williams & Abbott's New Magneto Bell.

The cut shows a new magneto bell for telephone or testing purposes, manufactured by the Williams & Abbott Electric company, 9 and 11 Huron street, Cleveland,



THE DUGGAN CLEAT.

Ohio. The ringer is of an entirely new design, the permanent magnet is of the tri-polar type and forms the support of the armature. The permanent and electro-magnetic circuits are in the same plane, and the action is such that the ringing current tends to magnetize the permanent magnet, and thus, with absolute certainty, prevent it from losing its magnetism. The generator has cast brass cut gears with extra long bearings and very powerful permanent magnets.

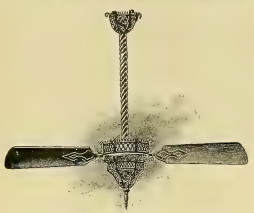


FIG. 3. EXTENSION OF DIEHL COMPANY'S BUSINESS.

It may be wound for the following voltages: 25, 75, 125, 250 and 500 volts. The telephone magnetos are wound to ring from 10,000 to 100,000 ohms. The testing bells are wound to ring from 50,000 to 150,000 ohms. The company also makes a specialty of long-distance bridging bells with a large number on a circuit.

The Ohio Valley Telephone company awarded the contract for the construction of the new telephone exchange to J. H. Wood & Bro. Work will begin in a few days, as soon as the poles arrive.

## The Duggan Cleat.

The Imperial Porcelain Works of Trenton, N. J., have just gotten out three new sizes of the one-piece Duggan cleat, shown in the cut, also a three-wire Duggan cleat, which they are ready to put on the market. This is a leading cleat, and it is said that there are more of these cleats used than of all others put together.

The company is also making a fine line of the thinnest wall porcelain tubing in all sizes and lengths. It has recently remodeled its tubes, making the outside diameter as small as possible. J. B. McKeague of 569 Wabash avenue, Chicago, is the western agent for these specialties.

## Extension of Diehl Company's Business.

The incorporation of the Diehl Manufacturing company of Elizabethport, N. J., and New York is one of the pleasant indications of a large extension of business

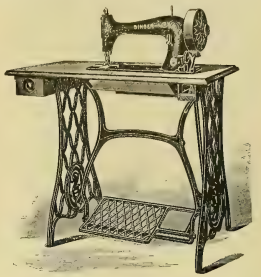


FIG. 4. EXTENSION OF DIEHL COMPANY'S BUSINESS.

in the electrical field. This concern started from a small beginning in the manufacture of ceiling fans, after which it began the manufacture of the Diehl dynamos and motors, and on account of the business growing beyond all proportions of what was anticipated, it found that its interests could be better served as an incorporated company, and this step was taken recently. The company's present facilities for manufacture are being taxed to their utmost, and two sets of men are employed to keep pace with the orders. A carload of Diehl ceiling fans was shipped to Chicago last week, this being

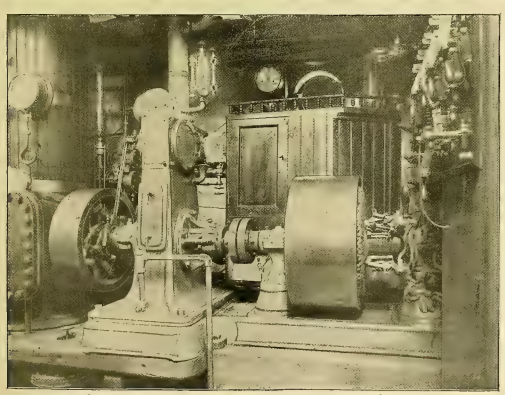


FIG. 1. EXTENSION OF DIEHL COMPANY'S BUSINESS.

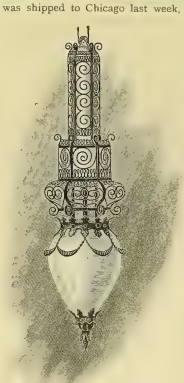


FIG. 2. EXTENSION OF DIEHL COMPANY'S BUSINESS.

probably the largest order of the kind ever sent West. One of the important additions to the business is the manufacturing of a new line of handsome Knight arc lamps, in a variety of styles, which for design are unsurpassed. The fan business this season is far in excess of that of any previous one, and when it is known that nearly 12,000 of these fans are alone in use, it will give an idea of the company's standing in the trade.

The illustration, Fig. 1, is a reproduction from a pho-

tograph of a Diehl dynamo directly connected to a Case engine. This installation is on board the steam yacht Reverie, owned by the president of the Singer Manufacturing company. These machines have the armature encircling and revolving around the field magnets, which results in high efficiency, great durability and slow speed, avoiding the method of countershafting and the loss of power it incurs. This slower speed, being due to the large diameter of the armature, is obtained without increase of weight and gives a starting torque proportionately great, at the same time increasing the efficiency by a diminution of friction of the bearings and the brushes. The motors are fitted with self-aligning and self-oiling bearings and approved brush-holders, thereby requiring a minimum of attention.

The illustration, Fig. 2, of the new Knight arc lamp hardly does justice to the elaborate line which the Diehl company is preparing, and for the outdoor lamp the company has perfected a design which will be waterproof without the use of a hood. The important feature which will recommend the Knight lamp is that the striking magnet is composed of a few turns of heavy wire placed in the main circuit, and, when the current is on, this magnet is energized and pulls down the core of the shunt armature, holding the core in this position until it is weakened by the lengthening arc, then the core of the shunt magnet is released and it goes up to the feeding point. The armature is then practically outfield of the striking magnet and the arc depends entirely on the shunt magnets for regulation. This avoids the defect usual in the shunt lamp of not striking a proper arc when current is turned on. The adjustable chuck carbon holders take in any size of carbon from one-fourth of an inch to five-eighths of an inch in diameter. The clutch wheel is used, requiring no dashpot or main magnets. The clutch is applied to the periphery of the wheel; therefore the rod is less liable to stick when dirty than in a lamp with clutch working directly on the rod.

Fig. 3 shows a beautiful Venetian design of ceiling fan, one of the many which this company has offered for sale this year. It is of polished brass and nickel and variously ornamented styles, the important feature being, moreover, that a material decrease in the amount of power required has been made. The self-oiling motors in these fans are directly coupled to the fan shafts and operate on any direct current circuit or work successfully in series on arc and street railway circuits.

Fig. 4 shows the balance-wheel motor, as applied to the shaft of sewing machines. The motor is self-contained and the field magnets are attached to the shaft of the machine for connection with the current. The armature carrier acts as a balance wheel and is secured to the shaft by the clamp-stock motion. The speed is manipulated by a small brake and rheostat operated by treadle.

Patterns are now being made whereby the Diehl dynamos and motors of large size can be handled, and a general line of apparatus will be manufactured to meet the desires of any possible purchaser. Contracts have been given for a large amount of new machinery, which will be installed in the near future.

At a recent meeting held by this company, the following officers were elected: E. H. Bennett, Jr., president; Philip Diehl, vice-president; H. S. Miller, secretary, and J. A. Reid, treasurer.

President E. H. Bennett is a gentleman well known among the electrical trade and general mechanical industries of the East. He states that it is the intention of this company, at an early date, to largely increase its manufacturing facilities, that it may meet the rapid growth of the business.

The company has secured the services of John C. Knight as superintendent of the arc lamp manufacturing department. Probably no one is more prominently and favorably known in connection with the arc lamp industry than Mr. Knight. In nearly all of the large cities of this country will be found lamps of his design. The New York office will be at 561 Broadway, and under the management of C. A. Bramhall, who for many years has been identified as general sales agent for prominent companies engaged in the arc lamp and motor business. He has a large following of friends, who will be glad to hear of his continued progress in the business. M. T. Lindenburg will be in charge of the Boston branch, at [illegible].

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The council of Council Bluffs, Ia., is considering an underground wire ordinance. The Nebraska Telephone company, [illegible] that to oppose the ordinance [illegible] postpone the matter, as the improvement [illegible] and that it will not fight it. It estimates the cost of burying its wires at $25,000.

## Novelty in Central Station Practice.

A novel method of central station working with modern alternating current apparatus has recently been installed for the Seneca Light & Power company of Seneca Falls, N. Y. The engineering plant as well as its practical application is the work of N. T. Wilcox, who has enjoyed a large and varied experience in both lighting and power work. This installation is especially interesting, as it is the first instance where two alternating current machines, located in stations a considerable distance apart, have been operated in multiple and under the conditions incident to every-day central station practice.

This company has installed two General Electric 100 kilowatt tri-phase composite wound 60 cycle generators operating at 2,300 volts, one being located about four miles from Seneca Falls, in the Waterloo station, which is operated by water power only. Lights and power are furnished for general distribution at both ends of the line. The duplicate generator is located in the Seneca Falls plant, where there is both steam and water power. These two machines replace an Edison three-wire system in Waterloo and a 500 volt direct current motor system and single-phase alternating current system in the case of Seneca Falls. The incandescent lighting load for both towns has been ordinarily operated on the Waterloo generator, the Seneca Falls machine being used only in emergencies or at such times as it was desirable to shut down the Waterloo plant. There being a large surplus of power at Waterloo the greater portion of the night, it is desirable to use this for street lighting, but in case of low water it is necessary to have the arc dynamos in Seneca Falls, where there is steam power for emergencies of this kind, consequently it is desirable to transmit this surplus to be used on the main shaft of the Seneca Falls station.

This problem is admirably solved by synchronizing the generators and throwing them in multiple, working both lights and power over the three No. 6 B. & S. wires which connect the Seneca Falls station to the Waterloo plant, nearly four miles apart. The Waterloo wheels are then run at full gate, transmitting their full power to the Waterloo generator.

The regulating is done at the Seneca Falls end. The surplus power not required for incandescent light supplies energy to operate the Seneca Falls generator as a synchronous motor, transmitting power to the line shaft. As the lighting load falls off, more of the energy is used in driving the shaft until the amount of power delivered to the line shaft entirely relieves the engine of its load and the steam power is cut off.

By carrying a strong field on the Seneca Falls generator all drop of potential due to inductance in the line is entirely eliminated.

The working of the system is admirable, the incandescent lights at both of ends of the line being steady and under perfect control, and the gain in economy of operation of the plant is very noticeable.

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## The Evolution of the Arc Lamp.[1]

By L. H. Rogers.

Part I.

For the purpose for which it is intended to be used, the arc lamp, as we commonly know it, is, mechanically and electrically, the poorest designed and constructed piece of mechanism on earth.

The author of such a statement could only conscientiously proclaim it upon such an occasion as this—before a body of men who are thoroughly familiar with arc lamps, who can instantly spot the first sign of a lack of logic in the argument which must necessarily follow such a radical statement.

Washington was still alive when Volta, a Frenchman, discovered the energy displayed in the consumption of certain metals when immersed in acids. It was simply impossible for him to have realized at that time what the invention or discovery of the primary battery meant.

A few years after this, in 1802, Sir Humphrey Davy connected up a large number of Volta's cells. He connected the positive of one cell with the negative of the next one, the positive of that with the negative of the next, and so on. After connecting about 2,000 cells together thus, in series, he attached a piece of charcoal to the positive of one end of the line, and another piece of the same material to the negative of the last cell in the row. Then, first touching the pieces of charcoal together, and afterward drawing them slightly apart, the first arc lamp was produced. The pieces of charcoal were in a horizontal position, and as the heated atmosphere between the points caused the flame or mass of illuminated particles to bend upward in the form of an arch, the name of "arch" light was given to this new form of illuminant. This term has since been changed to "arc."

History gives us no information regarding the importance attached to Davy's new light by his neighbors, his wife, or even his scientific associates. It is more than probable that all of them looked upon him as a cranky old professor, foolishly wasting his time and money. Certain it is that it was utterly out of the question for any-one of that time to imagine that before the close of the century Davy's light would become the commercial light of the world.

In fancy, I lead Davy through the city of Philadelphia, with her streets illuminated by 6,351 arc lamps, the best lighted city on earth, and try to catch some conception of his thoughts, as he realizes what his two pieces of charcoal have done for mankind.

It requires 1896 to appreciate 1802.

Someone has said that Faraday was the greatest discovery of Davy. It must have been that Davy's teachings found good and fruitful soil when instructing his youthful pupil. It was in 1832, three years after the death of Davy, that Michael Faraday discovered the principles of electro-magnetic induction. This was a giant stride in the ultimate development of the arc lamp, for the reason that by the applications of these principles the modern dynamo was born. What Faraday did for the world can better be understood if we can imagine primary batteries of equal capacity and power, in lieu of all the dynamos now used for arc and incandescent lighting. The contemplation is sufficient to cause us to love Michael Faraday.

In place of the large number of troublesome and cumbersome cells, the electric potential or energy necessary to maintain an arc between the two pieces of charcoal was now generated mechanically, rather than chemically, with one piece of machinery, rather than a large number of acid-slopping jars.

No sooner had Faraday announced his discovery than scores of inventors and experimenters began to construct and perfect dynamos. Some great mind like Faraday, or Röntgen, lets down the bars to the Elysian fields, and thousands rush in and stake out all the choice corner lots. These swift-footed inventors, however, are necessary to the evolution of an industry.

Beginning with 1832 one dynamo followed another in rapid succession. Each successive machine embraced some new device or new idea overlooked in its predecessor.

Improvements also began to be made in the device which transformed the electric energy into light. Davy's light, although blinding to the eye, became wearisome, simply as an experiment. It was found that the pieces of charcoal were gradually consumed as they were burned, the one attached to the positive end at the rate of about twice that at the negative end. This led to the necessity of providing some means of feeding the pieces of charcoal toward one another as they wasted away. The pieces of charcoal themselves were improved. They were hardened and baked, and thereafter called carbons.

Thus began the arc lamp on its long, rough journey toward perfection. The first efforts were very crude. The electric current passing through the lamp was utilized to cause a screw to revolve slowly. At the end of this screw was attached the positive carbon, which in this manner was fed toward the lower or negative carbon.

It is easily seen that the nearer the carbon points approached each other the less became the resistance, and the greater became the flow of the current. Likewise the greater the distance between the carbon points, the greater the resistance, and the less the flow of the current. This ebb and flow of the electric current provided magnetic power of varying strength which was early seen could be utilized to operate the mechanism to feed the positive carbon. The disadvantage of this, however, soon manifested itself in the fact that as the current was augmented and diminished by the proximity and separation of the carbon points, the current in the line itself was proportionately affected. This made the operation of two or more lamps on the same set of wires impossible, for the reason that the carbons in the different lamps could not be depended upon to feed at the same instant, as well as the effect on the regulation of the dynamo.

The operation of more than one light from one machine was therefore attended with difficulty from the time of Faraday's discovery in 1832, up to 1875. Some little success was obtained during this period by running a set of wires from the machine to each lamp desired to be operated, though no illuminating to any extent was done in this manner except as a laboratory experiment.

About the year 1875, it occurred to a young electrician, Charles F. Brush, living in Cleveland, that if he could construct a device for an arc lamp which would regulate the feeding of that lamp without affecting the main line, it would then be possible to operate any number of lamps on one circuit, as the current momentarily required to operate the feeding mechanism in any given lamp would leave all the others undisturbed. This was a bold idea, and required inventive genius of a high order to carry it out.

Up to this period a magnet had been employed in the lamp mechanism, which consisted of a coil of wire wound around a hollow spool, into which was inserted an iron core. When the current was switched on, the action of the coil was to draw the core into the spool. This movement provided means for raising and lowering the upper carbon. Mr. Brush used two spools for added strength. The normal path of the current was around these two spools (in parallel) to the carbon, and down through the carbons and then to the negative terminal. He, however, constructed another possible path for the current. Attaching a wire of quite small cross-section to the main wire, he wound it on the same spools, but in an opposite direction to that of the coarser wire. This fine wire, after leaving the spools, passed directly to the negative terminal, making what was termed a "shunt" around the arc. The effect of this unique arrangement was the same as a controller on an engine. The more current passing though the fine wire

1. Read before the National Electric Light Association, New York, May 7, 1896.

the weaker the magnet became, and the all-important point gained that each and every lamp was a law unto itself, establishing and regulating the arc, and feeding without influencing any other lamp on the circuit

The device termed "differential winding" or "feed" was entitled successful, and to Charles F Brush belongs the credit of first giving to the world commercial arc lighting. He accompanied this invention with one not much less in importance

He invented a cut out, a device for cutting out any given lamp, provided any trouble should happen to that lamp so that it could not burn This cut-out insured the absolute maintenance of the main circuit, no matter what might happen to any single lamp

Visitors to the World's Fair in 1893 will not soon forget the impressive exhibit made by Krupp of Germany, the gunmaker of the world Here at one side was shown a piece of iron eight inches thick, and there by its side a gun invented for the special purpose of piercing that piece of iron with a projectile At the next step was seen a thicker or tougher piece of metal, with a more powerful gun to pierce it And thus the race between gun and metal was maintained, until a weapon 35 feet long, mounted upon a carriage which was revolved, lowered and elevated by special machinery, was exhibited, of such power that it could throw a 2,200 pound ball two miles, and at that distance pierce the toughest wrought-iron plate 36 inches thick

In a somewhat similar manner a race has been in progress between the device for generating the electric current and the device for transforming the current into light—the dynamo and the lamp. Volta invents a battery and Davy matches it with his lamp—a light formed between two pieces of charcoal. After 30 years, Faraday discovers an entirely new method of producing the electric current, and scores of inventors immediately proceed to improve the lamp to meet the new conditions. For 40 years after this time improvements in the dynamo and lamp proceed by easy stages, hand in hand, until the invention of the differential winding, which placed the lamp far in advance of the dynamo. Immediately this winding was perfected then began the rapid improvement of the dynamo, to meet, if possible, the new and improved conditions brought about by its use. For the past 20 years and more this improvement of the dynamo has been in progress, until to-day machines highly efficient, close in regulation, and producing current for 125 2,000 candle power arc lamps are as common as the poorly constructed, inefficient 16 light dynamos of 20 years ago.

These large machines are wonders in their class. It is possible to throw all of the lamps in or out of the circuit at once, break the main line, or, in fact, do anything to break down the machines electrically, and they continue to run, automatically taking care of their load, and without the least hitch of any kind. The efficiency of these machines is, in some cases, as high as 90 per cent. In short, perfection has about been reached in the arc dynamo.

On the other hand, the arc lamp as it stands to-day is a poor affair compared to what it might be. It is far behind the arc dynamo as regards electrical and mechanical perfection. What was considered good enough, or even perfect, 20 years ago, will not answer to-day New uses have arisen for the electric light, and its adoption as an illuminant has exceeded any prophesies ever made for it The dynamo has again more than outreached the lamp, and the time for a new lamp has arrived.

## West Side Park Lighting Contracts.

The contracts for the large arc lighting plant in Garfield Park were awarded on Monday by the West Chicago park commissioners. The specifications were prepared by Forée Bain, the engineer of the board, and awards were made as follows:

Boilers—(500 horse power water-tube boilers in two units)—Standard Boiler company, Chicago; $6,300.

Condensers and pumps—Nordberg Manufacturing company, Milwaukee; $5,500.

Heaters—Harrison Manufacturing company; $865.

Engine—(650 horse power cross-compound Corliss)—Filer & Stowell, Milwaukee; $9,700.

Jack-shaft, clutch pulleys and rope drive—Dodge Manufacturing company; $4,000.

Dynamos—(Six 150 lighters)—Excelsior Electric company, New York; $1,484 each.

Arc lamps—(750 for double service and series wiring)—Adams-Bagnall Electric company, Cleveland; $22.50 each.

Cables—(300,000 underground cable and 30,000 feet rubber covered wire)—Washburn & Moen Manufacturing company, Worcester, Mass.; 11 3/16 and 7½ cents a foot.

Marble switchboard—Western Electric company, Chicago; $1,250.

Two-ton pulley block and crane—Whiting Foundry.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, May 16.—A curious story of the theft of current from an electric railway company for use in incandescent lighting comes from Brooklyn. The complainant is the Brooklyn Heights Railway company and the accused a saloon-keeper named Rademacher. One night in October last, according to the story told, Henry M Brockbank superintendent of electrical construction for the company, was going through Ralph avenue, when he saw the electric lights in the saloon of Richard Rademacher, at the corner of Monroe street, flicker for a few moments, and then go out, and then come up bright again, as the incandescent lights in the trolley cars sometimes do. He thought that was a queer way for Edison lights to behave, and he decided to make an investigation of the electrical arrangements of Rademacher's place. Mr. Brockbank entered the saloon, and in course of time passed to a side room, and there unscrewed one of the incandescent bulbs. As he expected, other lights went out, all that were wired on that branch circuit. He was satisfied that Rademacher's electricity was obtained from the railroad company's wires that were strung along Ralph avenue in front of the saloon. He reported the matter to the company. Watches were corrected to agree with each other, and it was ordered that the current supplying the Ralph avenue road be shut off at a certain time on the following night, when Mr. Brockbank was to be in front of the saloon. The plan was carried out, and duly at the time appointed for the cutting off of the current the illumination in the saloon ceased, while a car that happened to be passing was deprived of its light and motive power. When the current was turned on again the car and the saloon were lighted at the same time, and the car went on. Thus Mr. Brockbank had further evidence that his company's plant was supplying the light for Mr. Rademacher's saloon. An examination then disclosed a secret connection between the saloon lights and the railroad wires. In front of the saloon is a tree among the branches of which the feed wires of the trolley system run. From one of these wires, the railroad people say, another wire ran at right angles toward the saloon, passing under a stationary awning and through the hall of the family entrance to the saloon. The connection to the feed wire was made by means of a nail. The saloonkeeper was arrested, but pleaded innocence of any knowledge of fraud. He said that the lights had been put in by a man who claimed to represent a new company.

I have been amused by a grotesque attack on your New York correspondent in the new monthly publication known as *Electrical Doings*, which gives the burlesque touch to the varied aggregation of electrical journals in New York. In a previous letter I noticed this fledgling, but in return I am styled "an ignoramus," an "anonymous scribbler" and an "owl-like correspondent," while the WESTERN ELECTRICIAN is advised to improve upon its representative by employing a buttermilk vendor or a Bowery bartender. This is crushing. It is hardly worth while to point out that the point of my mild criticism against the preposterous statement, "Electricity has become a force in nature," has been totally missed by the tyro of *Electrical Doings*. The new paper can safely be left to expose its own lack of knowledge. W. F. O.

# PERSONAL.

Hugo Benedix has resigned as president and general manager of the Boudreaux Dynamo Brush company. He has labored earnestly and intelligently to build up a new business. The new organization possesses sufficient capital to carry on the business on a larger scale.

# TRADE NEWS.

The Goubert Manufacturing company of New York has opened a western office at 1403 Monadnock block, Chicago, in charge of E. Webster, well known in engineering circles as an expert in steam practice, who was for many years with the Stilwell-Bierce & Smith-Vaile company

Francis Jehl, heretofore representing F. Hardtmuth & Co. of Vienna in this country, has received notice from his firm that his presence is required in Vienna, and that arrangements have been made with the New York bankers, Machado & Roller, 203 Broadway, to conduct the business during his absence.

The Brown & Sharpe Manufacturing company of Providence describes "The Latest Addition to Our Machine Shops" in a recent pamphlet. The building seems to be a model in design and construction, but the electrical engineer will note with disapproval the reliance placed on a cumbrous and complicated system of belting for the transmission of power.

The most gigantic "scoop" in electrical circles which has taken place within the last few years was secured on last Monday, when the Adams-Bagnall Electric company was awarded the contract for 750 series arc lamps at the West Side parks, Chicago. The peculiar feature of this deal is that L. H. Rogers, the general manager of the Adams-Bagnall Electric company, had just returned from the National Electric Light association convention at New York, where he read a paper on the "Evolution of the Arc Lamp," in which he contended, and gave his reasons therefor, that the day of the double-carbon lamp had passed. Within 10 days after reading his paper Mr. Rogers had the satisfaction of receiving this large and important order for series arc lamps at $22.50 each, against double-carbon lamps offered at much lower prices, the lowest bid being more than $8,600 below the Adams-Bagnall bid. Mr. Rogers is naturally very much elated over this evident confirmation of his prediction

The Anchor Electric company of Boston has just placed on the market a new advertising device which ought to be received with favor by merchants and others looking for attractive signs for show windows It is called the "Anchor lamp sign," and consists of small brass attachments which are easily fastened to common receptacles and which firmly hold in front of the lamp ground glass plates, on which letters are painted, and are so arranged that the signs can be readily changed. C. O. Baker, the Chicago agent of the company, states that the price is sufficiently low to permit of general adoption and extensive use.

A fine catalogue shows the high grade of engines, boilers and pumps turned out by the Murray Iron Works company of Burlington, Iowa. This company has a deserved reputation for the excellence of its products. Its facilities are unexcelled. The foundry is the largest in the West; the machine shops the largest in the state; the boiler shops the largest in the Northwest. The three departments are worked harmoniously together, so that their combined product is placed upon the market at the minimum cost of production. The situation at Burlington, Iowa, on the Mississippi River, where freight rates are divided, is central and advantageous. Sidetracks run directly into the shops, and are spanned with traveling cranes, so that the heaviest machinery is handled with ease and shipments made under cover.

The manufacture of boilers, radiators, etc., for the distribution of steam and hot water has become a most important branch of manufacturing enterprise. One of the leading organizations in this country engaged in this line of production is the American Boiler company, which has its principal office in Chicago, occupying the main floor and basement at 84 Lake street. The company was organized on February 1, 1896, succeeding to the business of the National Hot Water Heater company of Chicago; the Detroit Heating and Lighting company of Detroit, Mich., and the steam and hot water heater business of the Pierce, Butler & Pierce Manufacturing company of Syracuse, N. Y., and the Richardson & Boynton company of New York and Chicago. The company operates large factories in Syracuse, N. Y., Brooklyn, N. Y., and Detroit, Mich., employing hundreds of hands, and enjoys facilities of the most complete and adequate character for the manufacture of its superior products.

# BUSINESS.

The Hunter Fan & Motor company is the name of the successor to the Tuerk Water Meter company of Fulton, N. Y., manufacturer of electric ventilating fans.

W. R. Ostrander & Co., manufacturers of electric and speaking tube goods, have removed to No. 22 Dey street, opposite the Havemeyer building, New York.

The material known as "rubber batten," said to be especially adapted for electric light engines, street railway use and other electrical purposes, can be obtained of William H. Scheel, 78 Pine street, New York.

The Culver Manufacturing company of Scranton, Pa., manufacturer of valves, separators and other steam specialties, claims to make the very best goods in its line and points to the testimony of users as proof.

The Hayes, Tracy, Fyfe company, manufacturer of automatic motor rheostats, can now be found at 225 West Twelfth street, Chicago. With increased space and enlarged equipment, it can now fill orders promptly.

The Electric Appliance company's complimentary duplicate order-book advertising scheme has proven to be a big success, and the books are much appreciated by customers. The Electric Appliance company still has a number of books left, which will be sent free on application.

Cutter's "arc light miscellanies" are described and illustrated in a small pamphlet issued as a supplement to George Cutter's 1895 catalogue of specialties. Information is given of a number of useful devices. The little book can be had of George Cutter, 851 Rookery, Chicago.

Another evidence of the remarkable success with which the Hawley down-draft furnaces have met all over the world is to be found in the fact that the company has shipped furnaces for six 220 horse power Babcock & Wilcox boilers now being built in Glasgow, Scotland, for the Tokyo Electric Light & Power company in Japan. General Manager S. T. Bleyer of the Hawley Down-draft Furnace company recently returned from Paris after superintending a 10 days' test with Hawley furnaces attached to boilers of the Quai de Javel pumping station of Paris, and this test gave entirely satisfactory results.

Incandescent lamp buyers throughout the West will be interested to know that James C. Wormley & Co. are now established in handsome quarters at 529 Marquette building, Chicago. As is well known, Mr. Wormley was formerly located in the East, and came west with the idea of pushing most energetically for trade, in this section particularly. Already his prospects are most encouraging. Mr. Wormley carries a very complete line of incandescent lamps. He claims that the "Wormley" 220 volt lamp "cannot be beaten." Chicago's supply houses, as well as other firms in western cities, are show-

ing appreciation of Mr. Wormley's very full line of incandescent lamps. These include arc and alternating series lamps, 150 to 250 volts, and all types of miniature lamps. It would be impossible to enumerate in detail the various styles of Wormley lamps, but it may be said that a specialty is made of high voltage lamps of 150 to 250 volts, 10, 20 or 32 candle power, four watts per candle power; also of arc system series lamps, 10 to 75 candle power, 2 to 10 amperes, and alternating series lamps for street lighting, 20 to 50 candle power, 2½ to 5½ amperes. Mr. Wormley is giving particular attention to the bicyle trade, and carries an excellent "pea" lamp suitable for the bicycle outfit. Taking all in all, Mr. Wormley feels very much encouraged, and, as, he states, he has three men now on the road and many most excellent testimonial letters are coming in, he feels that the Wormley lamp is being well appreciated in western territory.

Manager Hobart of the Triumph Electric company of Cincinnati reports a very encouraging increase in business. Among the more important deals closed in April were the following: Caledonia Electric Light & Power company, Owosso, Mich., one 150 kilowatt 550 volt generator, directly connected to Fischer engine; Owosso & Corunna Traction company, Owosso, Mich., two 65 kilowatt 550 volt generators, belted; Lane & Bodley company, Cincinnati, Ohio, one 100 kilowatt belted generator; Studebaker Bros. Manufacturing company, South Bend, Ind., one 65 kilowatt belted generator; Hot Springs Hotel company, Hot Springs, Va., one 55 kilowatt generator, directly connected to Buckeye engine, and one 30 kilowatt belted generator; Krippendorf, Dittman & Co., Cincinnati, Ohio, two 65 kilowatt generators, directly connected to Willans engine; J. M. High & Co., Atlanta, Ga., one 45 kilowatt belted generator; U. S. snagboat E. A. Woodruff, Cincinnati, Ohio, one 10 kilowatt generator, directly connected to vertical engine; A. H. Ely, New York city, one 80 kilowatt type W generator, directly connected to Ames engine; Sol. Sayles, New York city, one 25 kilowatt generator, directly connected to Woodbury engine; Nordberg Manufacturing company, Milwaukee, Wis., one 30 kilowatt generator, belted; John B. Mallers, Chicago, Ill., one 15 kilowatt generator, directly connected to Fischer engine.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued May 12, 1896.*

559,792. Electric Switching Apparatus. William W. Dean, St. Louis, Mo. Application filed January 24, 1896.

A plug is provided with a core and a sleeve adapted to engage with and move suitable contact springs; a space intervening between the core and sleeve in which the spring or springs engaged by the core enter.

559,796. Electrically Operated Railway Switch. August C. Goetz, Milwaukee, Wis. Application filed August 24, 1893.

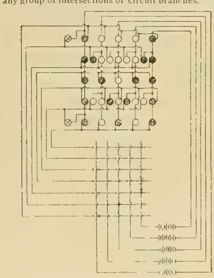
An insulating section for an electric line is provided, consisting of a block of insulating material, to one edge of which the electric line is attached, and having a short wire attached to its opposite edge, the short wire being insulated by the block from the main line.

559,801. Electric Light for Bicycles. Benjamin B. Hoffman, New York, N. Y. Application filed May 24, 1895.

In a lantern case there are a reflector removably secured and a lamp socket located entirely beneath the reflector. The lamp is carried in the socket and extends through the lower wall of the reflector. When the lamp is removed from its socket the reflector can be removed.

559,821. Telegraphic Printing Apparatus. Hollon C. Spaulding, Boston, Mass. Application filed April 23, 1895.

The electrical feature of this invention comprises a circuit-selecting device, consisting of sets of circuit branches, one set superposed upon the other so as to bring the branches of one set across the branches of the other, in combination with a key having a plurality of contact controllers corresponding in location with determined intersections of the circuit branches, so arranged that by the operation of the key electrical connection between the branches of the sets may be controlled and determined at any group of intersections of circuit branches.



NO. 559,821.

559,837. Electric Telephone Transmitter. Nathan Bassett, Philadelphia, Pa. Application filed November 14, 1895.

The device includes a pair of terminal electrodes fixed in variable inclined positions relative to the diaphragm, and a movable electrode arranged to bridge the terminal electrodes and to bear or press against the diaphragm.

559,863. Electric Arc Lamp. Samuel E. Nutting, Chicago, Ill. Application filed October 18, 1893.

An arc-drawing magnet, a shunt circuit around the arc, and means operated by the magnet for varying the resistance of the shunt circuit around the arc in constant potential arc lamps are described.

559,869. Selective Signal and Lock-out System. Charles E. Scribner, Chicago, Ill. Application filed May 18, 1895.

A telephone line is employed, made up of two line conductors not directly connected together at any sub-station, together with a ground branch from one line conductor, including a source of current, a ground connection from the other line conductor including a signaling instrument adapted to be operated by the current, and a switch at a sub-station for connecting the line conductors together.

559,872. System of Electrical Transportation. Philip K. Stern, St. Louis, Mo. Application filed September 16, 1895.

One claim is for an electric transportation system, consisting of a route or line of travel, a vehicle adapted to travel along the route, a primary inducing element arranged along the route, a laminated wheel mounted on the vehicle, and [illegible] current conductors on the wheel.

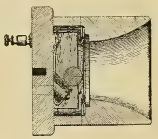
559,873. Telephone System. Walter F. Taylor, Montreal, Canada. Application filed August 3, 1894.

Included in the arrangement are movable keys provided with springs which tend to keep them in their normal position, terminals [illegible] in the path of each key and [illegible] which engages with the key [illegible] contact with the terminals, a pivoted lever adapted to disengage the catch from the keys.

when caused to turn on its pivot, a telephone instrument having a pawl on its hook, which, when the hook is depressed, engages unyieldingly with the lever and causes it to turn, and when the hook is elevated engages yieldingly therewith, the instrument being in circuit with the keys.

559,903. Steering Gear for Ships. Mathias Pfatischer, Philadelphia, Pa. Application filed August 24, 1895.

An electrical controlling device is connected with the rudder.



NO. 559,837.

559,904. Electrical Steering Gear. Mathias Pfatischer, Philadelphia, Pa. Application filed December 26, 1895.

The method is described of electrically controlling and adjusting, from a distance, a ship's rudder, gun, signal apparatus, or other adjustable mechanism, by introducing into the field magnet circuit of an electric generator a current corresponding in direction to the deviation of the controlling handle or device, causing the current thereby generated to control and apply the motive power for adjusting the adjustable mechanism, and causing such adjustment to introduce an opposing and equal electromotive force or current into the balance circuit and thereby stop the adjustment.

559,907. Running Compound Wound Generators in Multiple. William B. Potter, Schenectady, N. Y. Application filed February 25, 1896.

The means for adjusting the compounding effect of generators operated in multiple, consisting of a shunt around the series circuit of each of such machines, the shunt being substantially equal in resistance to the resistance of the series coil and its adjusting resistance.

559,910. Armature for Dynamo-electric Machines. Henry G. Reist, Schenectady, N. Y. Application filed January 31, 1896.

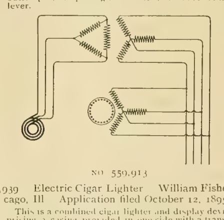
An armature spider having a central boss or hub, separate arms radiating therefrom, and provided upon their outer ends with dovetail grooves, and laminæ having dovetail projections fitting in the grooves, thus connecting the arms.

559,913. Alternating Current System of Distribution. Charles P. Steinmetz, Schenectady, N. Y. Application filed February 5, 1896.

The transformers have their primaries connected in delta, and their secondaries in Y, and a neutral or equalizing wire extends from the common junction of the secondaries only.

559,916. Electric Switch. Paul G. Tismer, New York, N. Y. Application filed March 29, 1895.

A roller-bearing lever with a body inclosing a movable portion, a swing between the two parts, a top-plate in separable pieces for holding the lever in position, and a push-button part comprising two branches that are secured to the lever.



NO. 559,913.

559,939. Electric Cigar Lighter. William Fisher, Chicago, Ill. Application filed October 12, 1895.

This is a combined cigar lighter and display device, comprising a casing provided in one side with a transparency or equivalent, an incandescent lamp arranged behind the transparency and connected with a normally open circuit, a torch holder for the torch, and a contact device operated by the torch, adapted to close the circuit through the lamp when the torch is removed from its holder.

559,988. Telephone. Theodore Berdell, New York, N. Y. Application filed March 8, 1895.

A diaphragm mounted in a magnetic field in a position of magnetic equipoise or stable equilibrium.

559,989. Telephone. Theodore Berdell, New York, N. Y. Application filed June 19, 1895.

Two independent diaphragms are loosely held in place and adjustment by magnetic force but out of contact with the magnet.

559,990. Telephone. Theodore Berdell, New York, N. Y. Application filed December 7, 1895.

A swinging diaphragm is located in a box or case of non-magnetic material between the poles of a magnet; there is also an adjustable regulating ring.

560,006. Dynamo-electric Machine or Electric Motor. Octave Patin and Leon Levavasseur, Paris, France. Application filed June 19, 1893.

A fixed magnet, the revoluble armature comprising coils and a metallic disk, the insulated rings arranged side by side around a sleeve of the armature, connection between the armature coils and the rings, and the segmental commutator and connections between the latter and the rings.

560,031. Electric Railway. John H. Guest, Boston, Mass. Application filed December 3, 1895.

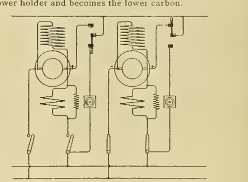
The system has a sectional working conductor, a rotary magnetic switch, a series of actuating coils therefor corresponding in number to the sections and charged in succession, and a circuit changer for reversing the order of connection of the coils, whereby the switch may be caused to progress in the normal direction when a car passes in the reverse direction.

560,035. Electric Regulator. Rudolph M. Hunter, Philadelphia, Pa. Application filed May 22, 1894.

In a regulator for electric motors, the combination of field magnets and armature relatively movable with respect to each other, devices to move one of the parts to vary its inductive relation to the other part, and switch devices movable with the movable part for decreasing the resistance after the armature has begun to rotate.

560,039. Electric Arc Lamp. Alvie O. Mackin, Anderson, Ind. Application filed October 3, 1895.

Claim one reads: In an electric lamp, the combination with the upper and lower carbon holders, and with a magazine designed to contain a number of upper carbons, of mechanism for successively and automatically feeding the carbons from the magazine into the upper holder, and for releasing at the proper times the upper and lower carbons, whereby the lower carbon is permitted to fall away from the lamp, and the partially burned upper carbon is caused to drop into the lower holder, together with means whereby said partially burned upper carbon is caught in the lower holder and becomes the lower carbon.



NO. 559,907.

560,076. Electric Programme Clock. Alfredo Antonio Cardoso E. Bastos, Sao Paulo, Brazil. Application filed March 20, 1894.

Projecting contacts on the dial engage the hand and complete the circuit.

560,087. Meter for Alternating Electric Currents. Thomas Duncan, Fort Wayne, Ind. Application filed December 21, 1891.

A coil or coils traversed by the current to be measured, a revolving secondary cutting the field or fields of force generated by such coil or coils in its revolution, a magnetic path diverter, a retarding device and a registering train are employed.

560,096. Electric Call Bell. Frank C. Jordan, Wadsworth, Ohio. Application filed March 20, 1896.

One claim is for the combination with the battery and electric bell, and the clock having its hour-hand in connection with one pole of the battery, of the annular rim to sustain detachable contact fingers, and detachable contact fingers adapted to rest on the rim and make connection with the hour-hand and the opposite pole of the battery.

560,097. Trolley Wire and Trolley Therefor. Herbert R. Keithley, Buffalo, N. Y. Application filed August 24, 1895.

A trolley wire having two ribs and two grooves, and means for supporting the trolley wire so that a trolley wheel may engage both of the ribs, and a groove between them.

560,098. Trolley Wire and Trolley Therefor. Herbert R. Keithley, New York, N. Y. Application filed March 28, 1896.

A trolley wire having three ribs, the sides of one or more of the ribs diverging outwardly.

560,168. Electric Lamp Socket. Harry W. Leonard, New York, N. Y. Application filed June 28, 1890.

This socket comprises essentially two insulated conductors permanently embedded in a single piece of non-conducting moldable or castable material, the exterior ends of the conductors being located beneath an overhanging ledge forming part of the socket.

Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, MAY 30, 1896. No. 22

## Conveying the Roar of Niagara by Telephone to New York.

By Orrin E. Dunlap.

One of the truly novel features of the electrical exposition in New York is the transmission of the roar of Niagara Falls by telephone, to which allusion has already been made in this journal. The illustration which accompanies this article shows the point at Niagara where the roar of the falling waters was received by the telephone. After investigation it was decided that some point near the Cave of the Winds would be the best place at which to gather the sound. Here one can get closer to the falls than at almost any other place. So at that point the telephone was placed. To reach the spot one descends the Cave of the Winds spiral stairway and walks toward the Center Fall about 200 feet. There on the rocky ledge a wooden box about 3½ feet long, three feet high and 1½ feet wide was placed. In this box a telephone with a solid-back transmitter was secured, and a sheet-iron funnel 20 inches long and about 14 inches in diameter at the outer end was fitted to the transmitter. Three standard batteries were placed in the box, but two only were used. About the box white canvas was wrapped to protect the apparatus from the constantly falling spray.

At the point where the telephone is placed there are two distinct sounds produced by the falling tons of water. One is a sharp hissing sound, like escaping steam, made by the water as it curls over the rocks below and goes sweeping out into the river. The other is the deep pounding roar made as the fall strikes the rocks or water below. First experiments made with the telephone placed 12 or 15 feet farther away from the falling water than that ultimately decided on and shown in the accompanying illustration, which, by the way, is the first correct picture presented, were successful in catching the sharper hiss of the waters. This sound was plainly heard in New York, but the deeper roar was not caught. It was for this reason that the change in location was made, and the roar as heard in the world-famed Cave of the Winds was dispensed in New York, 462 miles distant.

CONVEYING THE ROAR OF NIAGARA BY TELEPHONE TO NEW YORK.—VIEW SHOWING LOCATION OF TRANSMITTER AT THE CAVE OF THE WINDS.

## Electrical Consolidation in Philadelphia.

A press dispatch from Philadelphia announces that the negotiations which have been pending between the Pennsylvania Heat, Light & Power company and the combination of electric light companies known as the "electric trust" for the absorbtion of the trust by the Heat, Light & Power company have been closed. It is announced that the deal, which involves about $2,000,000, took effect on May 25th. The Pennsylvania Heat, Light & Power company will pay $130 a share for the 5,000 shares of preferred stock of the trust, and $40 a share for the 31,440 shares of common stock. The payment will be made in four installments of 25 per cent. each quarterly, the money being secured by assessments on the Heat, Light & Power company's preferred stock. By this deal the Pennsylvania Heat, Light & Power company secures control of the principal electric lighting companies of the city. The territory covered by the trust extends over the entire central portion of the city. The companies it controls have city contracts for lighting 2,449 arc lights for street lighting, for which the city pays about $500,000 a year. The Pennsylvania Heat, Light & Power company has, independent of the others, valuable franchises in the central section of the city. It purchased the Edison Electric Light company in January, and is said to have begun negotiations for the more extensive of the independent electric light companies which have franchises outside of the territory covered by the trust.

## Electrical Commission from Japan.

A press dispatch from San Francisco announces the arrival of a special commission from the mikado of Japan to study the workings of electrical power and the telephone systems in the United States. The commission is composed of S. Mine Natymaya and Y. Wadichi They will stop two weeks in San Francisco, Sacramento and Fresno and may visit eastern cities. They may also visit Europe. They expect to be absent from Japan six or seven months.

"All over our empire now," said Commissioner Natymaya, "there is great interest in electrical power and electrical progress. Electricity has been introduced in several cities, but the government wants it all over the country. It is the same with the telephones. We have seen the value of them.

"It is our intention to study into the workings of both systems in the United States. We want to generate electricity from the many powerful waterfalls in our country and use it for general power and light. Wherever we can we intend to use electricity. It will, according to the ideas of our government, be especially valuable in connection with our various public and private enterprises. It is our desire to utilize the long-distance telephone in Japan."

## American Street Railway Association.

The arrangements thus far completed for the meeting of the American Street Railway association at St. Louis this year are noted in a circular just issued by the secretary, T. C. Penington. He has also distributed a plan which gives an idea of the extent of the building in which the association will hold its convention, beginning Tuesday, October 20th, and continuing four days. The building, which is the one erected for the Republican national convention, is 260 by 180 feet. About 80 feet of the length of the building will be partitioned off for the sessions of the convention, leaving 180 feet square for exhibits, and all entrance to and egress from the convention hall will be through the exhibition hall; there will be no choice of space, every place on the floor being equally desirable. Exhibits of like character will be grouped together, and space will be assigned in the order of application. Wires carrying current will be brought into the building from the street railway circuit, the voltage being 550, so that all mechanical devices may be operated. The income from sale of space will go to the association, the executive committee having fixed the price at 10 cents per square foot, and ruled that no space of less than 100 square feet will be assigned. Applicants may have as many multiples of this quantity as they may wish, all in one body. Payment for space should be made to T. C. Penington, secretary and treasurer of the association, 2020 State street, Chicago, on or before October 1st. Application for space should be made to George W. Baumhoff, chairman of the committee on exhibits, Park and Vandeventer avenues, St. Louis. The management announces that it believes, from information already received, that this will be the most extensive exhibit of street railway supplies ever assembled at one time and place. Space must be applied for by August 15th. Assignments will be made as promptly as possible after that date, and exhibitors notified of their location. It is further announced that all exhibits should be in place and all work finished by Monday evening, October 19th, the evening prior to the opening of the convention. Possession of the hall can be had on Friday, October 16th, thus giving ample time for preparation. Watchmen will be in charge of the premises, so that exhibits will be safe.

## American Institute of Electrical Engineers.

At the annual meeting of the Institute in New York on May 19th and 20th the several papers announced were read The council nominees for officers were elected. The ticket was as follows: President, Louis Duncan; vice-presidents, Charles P. Steinmetz, Harris J. Ryan, Wilbur M. Stine; managers, John W. Lieb, Jr., F. A. Pickernell, William L. Puffer, L. B. Stillwell; secretary, Ralph W. Pope; treasurer, George A. Hamilton.

## The Evolution of the Arc Lamp.

By L. H. Rogers.

Part II.

Remember that the title of this paper is "The Evolution of the Arc Lamp," and that evolution denotes a continuous development. Since Brush perfected the fundamental principles of the commercial arc lamp, what has been done? In '75 the arc lamp was a great ball of wonderment. In '78 to '80 a few were induced to really try them practically. During the next decade the mad lighting fever was in full sway, and 250,000 arc lamps had been hung up in the United States by '90. The manufacturing companies were too busy shipping and collecting to think of anything but of something

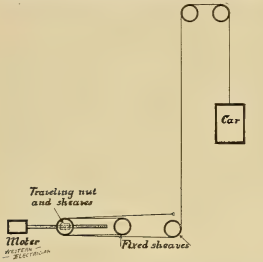



FIG. 1. SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

which would burn. The lighting companies were too busy making contracts with municipalities and supplying the demand for light to ever look to see what was inside the lamp.

But this is the age of close inspection. Municipalities are not paying $350 per year for a 2,000 candle power arc lamp in 1896. They encourage other companies entering their city limits, and this brings keen and active competition. If competition is not encouraged, or if prices for lighting are not reduced, the "taxpayer"—that tireless individual who never dies—is heard from, and starts the agitation for a municipal plant on the theory of his new discovery that electricity costs nothing to "make."

It is not the purpose here to discuss this swing of the pendulum from too high prices—it has indeed swung too far already in the other direction—but it does behoove us to examine closely into the daily expenses and annoyances to which the electric lighting plant is subjected.

There is no business which has developed so rapidly and so radically as that of electric lighting. The frame building, 20 feet square, has been replaced by a handsome brick and iron-roofed structure, 150 by 300 feet, and three stories high. The deliberate saw-mill engine, at 90 revolutions, has been replaced, first by the diminutive busy little high-speed engine at 350 revolutions, then by a larger type of the slow-speed engine, and later by a compound condensing engine at a piston speed of 800 feet per minute. The transmitting devices have been changed from belt to rope, and rope to direct. The boilers have undergone a radical change, and the manufacturer must now guarantee the pounds of water evaporated, per pound of coal, by his make. Remarkable and

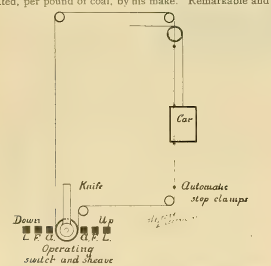



FIG. 3. SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

needed improvements have been made in the dynamo, as we have mentioned. The efficiency has been raised from 50 to [illegible] per cent. A 125 light machine is less trouble and care to run than an old 10 lighter.

In all this development, in this search for high efficiencies, in this attempt to get running expenses down to the minimum, in this effort to meet unjust reduction of lighting prices without operating at actual loss, the arc lamp has been overlooked. The most important single piece of mechanism in the entire system, it has been the last to receive serious attention.

There are [illegible] central lighting stations in the United States, with $320,000,000 invested. The sole and only object of this outlay is to get light. The engines, dynamos, belting, conduits, buildings are all secondary to the arc lamp. It is the exponent of the entire problem. It is literally in the "eye of the public" day and night. Its lines of—I was about to say beauty, but who ever heard of a beautiful arc lamp? At any rate it stands against the morning sky, or the evening sunset, and, in truth, I hear the public say, "It must be the best the electricians can do, for I have watched for 15 years, but have seen no change; they are all alike in their hideousness."

And now, let us look at the subject squarely. Let us hold the arc lamp up between the fluorescent screen and the Crookes tube, and in the light of X-ray '96 knowledge, examine the arc lamp hanging in our streets.

We find a device 50 to 60 inches long, made of long tubes, or chimneys, a sheet-iron drum, long side rods, and at the bottom a globe holder. We can see Davy's two pieces of charcoal—one is 12 inches long and the other six- the rate of consumption has not changed. We realize that the useful length of this lamp is the vertical length of the carbons. Dividing 18 inches by 50 inches we find that the useful length of this device is only 36 per cent. of its total length. The statement may be made by some enthusiastic observer that there are two pairs of carbons, one pair alongside the other, but he must not forget that with our improved eyesight in '96, we can look clear through the device and see not only the skeleton, but the marrow in the bones.

These carbons are fastened firmly in their respective holders, and the holders are rigid. The burning of the arc causes the carbons to point up quite decidedly. When the current is shut off momentarily, these points fall together, and it very often happens slip by each other and wedge. When the current is again sent through the coil, its lifting power is not sufficient to pull the carbons apart, the lamp is rendered utterly useless, the policeman reports it out, and a deduction is made from the bill of the lighting company to the city. To prevent these deductions amounting to more than the original bill, a corps of patrolmen is engaged, whose

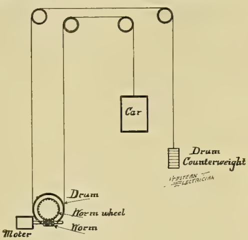



Fig. 2a.

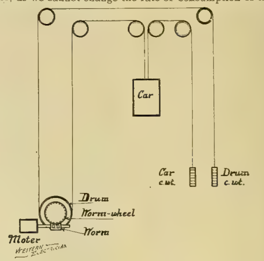



Fig. 2b.

SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

business it is to watch the lamps all night long, to prevent them going out, as a nurse would watch a sick child.

We find the interior of the devices full of springs, some of them with ratchets and cog wheels, some with six magnets or coils, all with three or more; springs without number and of every size; regulating devices, auxiliary levers, light and flimsy pieces of every shape and size; the device for gripping the rod, in most cases an annular ring gripping the carbon rod by tilting so that its knife edge holds on the side of the rod; the current being conducted to the carbon rod by means of a sliding contact; delicate brushes against which the carbon rod rubs as it feeds the carbons downward; cut-out spools which have little side shows of their own with independent armatures and additional coils of wire; carbon rods sticking away up into the dark recesses of the chimneys, rods which must be carefully housed and carefully cleaned with crocus cloth each day. We notice also that for three or four inches above the casing the rod cannot be cleaned by the trimmer; it therefore becomes spotted; a bit of weather or a bit of dust changes the nature of the brass, and the current carrying brush when it reaches this spot does not make a good connection; a little blister is formed which in turn blisters the surface of the brush, and this in turn blisters the rod the entire length until crocus cloth is powerless to smooth it. The lamp then must come in, for in the meantime many other little things have happened, and nothing but a thorough overhauling will put the lamp in good condition again.

It would require a volume to recount the details of the troubles that are occurring every hour, in every lighting plant, on the face of the globe. You, who are within reach of my voice, know too well that your arc lamps give you more trouble than all the rest of your apparatus combined. These troubles have come upon you so gradually, however, that you have become accustomed to them. It seems that some station men actually delight in keeping a force of men repairing old lamps, and a horse and wagon busy hauling them in and taking them out again.

Alexander Dow, electrician for the city of Detroit, connects four 100 light dynamos to one engine, for the reason, as he states, that the ratio of troubles is four to one. I wonder how many dynamos would be connected to each arc lamp, or arc lamps to dynamos, provided the number were dependent on the ratio of troubles.

And now, we have reached the year 1896; we have given the arc lamp a 20 years' tussle, and our troubles are increasing rather than diminishing. The lamp cuts the same kind of a figure against the sky as it did in the year 1875. Many details have been added in the interior construction, more magnets and more springs and more cut-outs and more chimneys, and less glycerine, but I do not think the statement can be denied that not one single idea of great merit has been added to the arc lamp between 1875 and '95.

If this be true, is it not time to consider the question seriously? Are we to give up the question, and acknowledge that, hanging in our streets is the world's best effort for the distribution of light through the medium of the arc lamp?

Is evolution to be the password to progression in all the arts, in fact in everything except the arc lamp?

To return to the opening sentence of this paper, "For the purpose for which it is intended to be used, the arc lamp as we commonly know it, is mechanically and electrically, the poorest designed and constructed piece of mechanism on earth."

I am not here to decry the lamp of any manufacturer. It is, however, pertinent to say that any lamp which will allow the carbons to slip by or wedge under any circumstances, is mechanically imperfect. It is an inherent defect in the lamp, and the damages or outages should be charged to the manufacturer of the lamp. What mechanician has determined that the proper way to hold two slim sharply pointed pencils in a coaxial position is to fasten them rigidly at their extremities, 18 inches distant, and then depend on their sharpened points nosing each other correctly? A very much better way would be to leave the carbon holder loose and free, centering by guiding the carbons near the arc. This would make trimming a very easy matter, and admit of cross-eyed men being employed. On second thought, however, we run immediately into difficulties, for, as we cannot change the rate of consumption of the positive carbon, the arc would soon reach one of the guides and burn it away. This would then require a lamp with a stationary arc, and that would require carbons of different diameters—upper and lower—and that would mean a great deal of thinking for the inventor and manufacturer; and so the lamps go out, and the station manager, believing that the arc lamp has been fully evolved, keeps sending his orders to the manufacturer, and the manufacturer will never improve as long as he can fill his orders with old style apparatus.

A sliding contact is a poor arrangement in an arc lamp. It has been tried as thorougly as any idea ever could be tried. It is the direct cause of the roughness of the rod. The resistance of the contact is too easily increased by the presence of a little dust. The sliding contact in the arc lamp must go.

The carbon rod itself is a troublesome institution. With an annular ring for a clutch, it must be kept in a uniform polished condition, or it will give trouble. It is responsible for the unsightly, hideous chimneys, which ought not to be in sight, and yet which cannot be draped. As we are building a new lamp let us dispense with the carbon rod altogether. We can then cut off the chimneys and shorten up the lamp. Then we can, without much trouble, parallel the carbons with the operating mechanism and increase the percentage of useful length to total length to at least 80 per cent. With a short lamp we can make a casing of light cast-iron in such shape as to avoid the necessity of a hood. We can also increase the carbon length, and if we do this we can choose our own size of carbons—that size for upper which will produce the largest crater and that size for lower which will best let the light out.

Thus we come back and meet, but overcome, our first difficulty. We construct a focusing lamp, and this leads us to the thought that there is only one correct position for the arc inside the globe anyway, and that the arc should be stationary. If we hang the upper carbon on a chain suspended over a sheave and attach the lower carbon to the lower end of the chain, we can, with proper adjustment, accomplish many things. As the upper carbon feeds downward as it is being consumed, the chain can be of equal weight, inch for inch, therewith. Therefore when an inch of upper carbon has been consumed and its weight taken from

the cross-head, an inch of chain has been added, and the armature remains in the same plane between the pole pieces of the magnet as before. This is an absolute necessity where the same difference of potential is required throughout the entire range of burning.

Thus, we are not restricted by the weight of the carbon, and can use whatever size is most suitable. It having been demonstrated that with 8, 9 or 10 amperes, a $2\frac{5}{8}$ inch carbon will produce a larger crater and give more initial light than any other size, it remains only to determine the length necessary for burning 14 to 16 hours. This length has been found to be 14 inches. With an upper carbon of $\frac{5}{8}$ by 14 inches, we find that $\frac{1}{2}$ by 12 negative plain will burn an equal length of time, leaving an equal stub and keep the arc practically in the same position during the entire run. This small lower carbon will let out the intense light in the crater of the upper, the increase of light at 45 degrees being something which would astonish most experimenters.

We must not forget that 420 millions of money is invested in the central stations alone in the United States, simply to get light, and more light with the same ex-

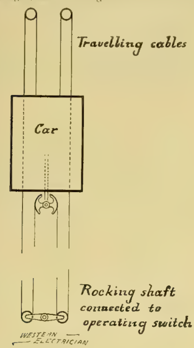



Fig. 4a.

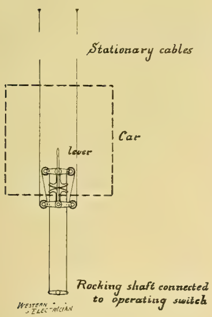



Fig. 4b.

SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

penditure of energy should be a welcome statement by those interested.

By quotations from all leading carbon manufacturing companies of the country, the point is discovered that a pair of $\frac{5}{8}$ by 14 and $\frac{1}{2}$ by 12 carbons is the cheapest possible combination for 14 to 16 hours burning. Anyone can test this point. It is simply the price of one $\frac{5}{8}$ by 14 plain and one $\frac{1}{2}$ by 12 plain carbon against three $\frac{1}{2}$ by 12 plain or $\frac{7}{16}$ by 12 copper-coated carbons. I have quotations in my pocket which will make a difference of $2.50 per lamp per year, assuming the full number of burning hours nightly, in favor of the $\frac{5}{8}$ by 14 and $\frac{1}{2}$ by 12 carbons.

Again, a $\frac{5}{8}$ upper and $\frac{1}{2}$ lower, loose at the joints and guided near the arc, will absolutely prevent wedging or slipping by, whether the lamp be shunt or differential.

I quote from a recent article by Alex. Dow of Detroit: "In the plant I operate, analysis of the 'outs' for two months showed that lapping was responsible for too much of the total trouble. We were running with $\frac{7}{16}$ inch carbons in both holders. We changed to $\frac{5}{8}$ inch uppers, retaining the $\frac{7}{16}$ inch lowers. Result for four winter months' operation of 1,480 street arcs, is just one 'out' by lapping." Mr. Dow is ahead of the lamp he tried to fix. He neglected to state that he was compelled to break his $\frac{5}{8}$ inch carbons off so that the weight would be no more than a $\frac{7}{16}$ by 12. This lamp was not designed on "evoluted" ideas. A heavier weight in the upper carbon holder would position the armature in a different plane as regards the operating magnet.

The double carbon lamp has outlived its usefulness. It filled a gap for a few years. Its only recommendation is that it will burn all night long. Its drawbacks are numerous. More mechanism is required. Two carbon rods with two sliding contacts. The arc is struck well up near the top of the globe at one side, not in the center, and travels downward. This causes an uneven heating of the glass, which results in globe breakage, especially in severe climates. I have known a number of superintendents who always took the precaution to crack their globes with a soldering iron before putting on, then by putting on a net the unequal expansion and contraction was overcome and the globe held in position. The globe question is a troublesome one at best. The globe should be fastened on without screws. Trimming should be done without touching or lowering the globe, and the globe should be cleaned without removal. If this can be done (and it can be) a bill from the globe manufacturer should be a matter for investigation.

Never losing sight of the fact that the function of an arc lamp is to diffuse light, as much light as possible, and in every direction possible, any unnecessary opaque substance which is interposed between the arc and the surrounding space to be illuminated shows a defect which is simply monstrous. With one pair of carbons burning 16 hours, we need have only one single arm of small cross-section reaching down to sustain the globe holder. The shadow from this arm can be thrown directly against the pole or building, leaving absolutely unobstructed light for the street.

It is a very noticeable fact that those who have had the most intimate acquaintance with arc lamps and have operated practically the largest lighting stations for the longest time are the men who are the most eager to hear of a lamp constructed on new principles.

The West Side Park commissioners of Chicago are about purchasing a large arc lighting plant, one of the largest ever installed at one time. The want 750 arc

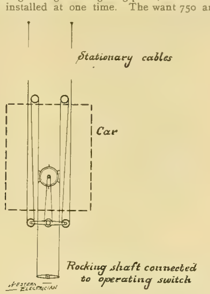



FIG. 5. SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

lamps. The specifications drawn by their engineer, Forée Bain, reached me a few days since. They are sufficiently unique to be preserved. His idea, I think, is new. He asks a number of questions. The bidder is to answer these questions on blanks furnished, the answers to form the guarantees of the bidders. These specifications read as follows:

Single or double carbon?
Size of carbon? Upper...... Lower.......
Cross section?
Market price of such carbons per 1,000?
Length of time the lamp will burn with one trimming, in circuit of 9.6 to 10 amperes and a difference of potential of 45 to 50 volts at terminals of lamps?
With $6\frac{1}{2}$ amperes and 45 volts?
Will the lamp burn at a practically constant voltage of 45 to 50 volts while the current may be changed from 9.6 amperes to $6\frac{1}{2}$ amperes?
If not, what range do you guarantee?
In stating guarantees do you refer to the use of plain or plated carbons?
State make of carbons referred to.
If such carbons are covered by patents, making them a monopoly, state price per 1,000 you hereby guarantee they will not exceed for a period of five years from date hereof?
By what means are the carbons adjusted to a coaxial position?
By what means are they maintained in a position coaxial with regard to each other?
What is the extreme length of lamp?
What is the weight of lamp with globe, trimmed and hung ready for operation, with hood and hanger board, if such be necessary?
How many side rods for supporting the globes and negative carbons?
Diameter of each intercepting the rays from the arc?
Length?
Is it necessary to remove or disturb the globe when trimming the lamp?
Does your lamp require a special globe?
If so, at what price do you guarantee they will not exceed for a term of five years from date?
Of what material is the jacket or case composed?
How removed for inspecting the operating mechanism?
Is the lamp shunt or differential?
After the arc is struck is the series coil retained in circuit?
Is its responsive mechanism in continuous active motion?
What is the electrical resistance of the series coil and its connections?
What is the resistance of the shunt coil?
Of what size wire is it composed in decimals of an inch?
How many active pivotal joints in operative mechanism?
How many springs in the lamp?
How many variable adjusting devices are there in the lamp?
Are they sliding or pressure?
Of what metal composed?
Maximum current carried?
Can they be readily replaced?
Will the automatic cut-out re-establish the arc when the carbons come together?
Within the limits of what number of volts can the cut-out be adjusted to positively operate?
If a double lamp, what is the difference of voltage between two pairs of carbons when in normal operation?
[illegible] time cut into the main circuit when the lamp automatically cuts out?
How [illegible]?
What is the [illegible] cross-section of the carbon feeding rod?
How is the circuit completed through the rod?
What is the area of surface contact of the clutch with the rod in decimal of square inch?
What is the voltage and current at which the lamp is best adapted to operate?
State the maximum and minimum voltage between which the lamp will operate and feed in practical service, during a period of six months.
Mention any special features of your lamp.

The man who could ask those questions is hunting for an arc lamp different from the ordinary. They show that he has fought and bled with a multiplicity of spools, springs, rods, sliding contacts, lapping carbons, broken globes and rusty sheet-iron cases, and that he has lived within the dark shadows thrown by the old-style lamps, and gazed for years upon landscapes marred by the contours of the arc lamps of the period of 1875 to 1895.

## Some Problems in Electric Elevator Work.[1]

By H. Cochrane.

In presenting this paper the writer does not attempt to bring out anything new, but will review some of the details of practical construction. These go to show that

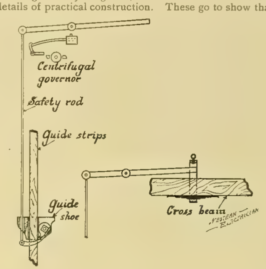



Fig. 6a.

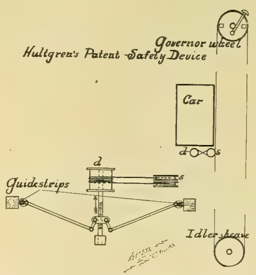



Fig. 6b.

SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

the application of electricity to elevator service is something more than merely attaching a cable to a motor, and involves a great many engineering problems. Some of the points set forth may possibly act as helpful suggestions in other lines of electrical work.

Broadly, the term elevator covers mine hoists and derricks, but is more commonly understood to mean hoists in buildings. Much of the hoisting machinery in mines is operated by a motor connected to a winding drum by a single or a double set of spur gearing.

The stopping is accomplished by a strap or shoe brake acting at the circumference of the drum at one end. This makes a very powerful and efficient hoist, but it would not give satisfaction if applied in buildings.

The requirements of service in buildings differing from those of outdoor or mine service are principally as follows: Higher speed, noiselessness, exact stopping and immovability when stopped.

The objections to spur gearing are these: It is apt to be noisy, even when running in oil; it offers greater difficulties in the way of exact stopping, which would be a serious objection where the travel of the car must be limited in the extent of its travel, as is the case in buildings. Again, the power required to brake a given load with spur gearing is greater than with some other forms, as will be seen later. The matter of immovability,

1. Read before the Chicago Electrical association, May 1, 1896.

too, when the machine is at rest under load is one of great importance, and since in the case of spur gearing either the small gear (pinion) or the large gear may be respectively the driver or the driven, this would not be a safe form to use in buildings where the car is in process of loading or unloading a great part of the time. Should the brake ever get slightly out of adjustment the difficulty of keeping the car from running away would be obvious.

The type of gearing almost invariably used for elevators in buildings is the worm and worm wheel, or some modification of that form, where the winding drum is used. In this case the worm shaft may be driven direct from a reversible motor by belting, or the motor may be belted to a countershaft running in one direction, from which two belts, one straight and one crossed, lead to the worm shaft. On the worm shaft are three pulleys side by side, the outer ones loose, or idlers, for the two belts, the middle one being keyed to the

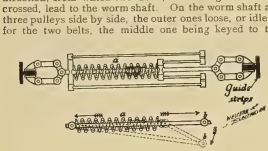



FIG. 7. SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

shaft. A belt shifter is arranged to be operated from the car, so that either belt may be thrown into action at will, giving the reverse motion to the worm shaft. It is customary, where possible, to make the crossed belt the one to be used for raising the loaded car, while the straight belt is used in causing the car to descend; the reason for this being that the crossed belt comes in contact with more of the circumference of the pulley, and thus will transmit more power, which is needed in raising the load. One advantage of this style of elevator outfit is that the motor does not have to start up under load. It may also be noted that an ordinary hand-starting rheostat is much cheaper than the automatic rheostat, which would be required with a motor that was belted directly to the worm shaft.

These two forms are usually termed worm geared belt machines, and it is common practice to attach the winding drum to the ceiling at any convenient floor of the building, while the motor is set on a foundation below, so that the belt will lead at a proper angle to the countershaft, or to the worm shaft, as the case may be.

The type used for nearly all electric winding machines for passenger, and in many instances for freight service, is that where the motor is coupled directly to the worm shaft and the whole mounted on an iron bed securely bolted to a deep and strong foundation. This is controlled by reversing switch and automatic starting devices.

Still another form of electric hoisting device is that styled the "hydraulic type," which uses the principle of the multiplying sheaves, Fig 1. Part of the sheaves are

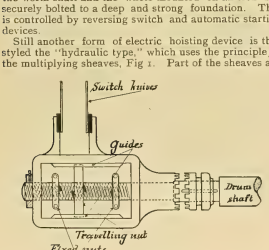



FIG 8. SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

mounted side by side upon a fixed stud, and are free to revolve thereon, while others, which lie in the same vertical plane, have an axis upon a sliding carriage and are free to move horizontally to or from the fixed sheaves. Attached to the movable carriage is a nut through which a screw passes, which in turn is directly coupled to a reversible motor. By a short movement of the traveling stud a much greater movement of the car is obtained, the ratio of movements depending upon the diameter of and the number of the pairs of multiplying sheaves (Fig. 1).

This form of mechanism allows the cable to lead straight from the machine to the overhead supporting sheaves in the hatchway. The diameter of multiplying sheaves generally is about 30 inches. The horizontal speed of the traveling nut is about 50 feet per minute. By using one, two, three or four pairs of sheaves and varying the distance through which the nut moves great range of car speed or travel may be obtained. The expenditure of energy with this form of elevator almost entirely takes place on the up trip, inasmuch as the weight of the car must exceed that of its counterweight sufficiently to insure the cable keeping their places on the sheaves during the down trip.

CAR SPEEDS AND LOADS.

For freight elevators speeds of 40 feet to 100 feet per minute are found in practice, a speed of 50 feet being very commonly called for in specifications. For passenger duty the public demands the highest speed consistent with easy starting and stopping, and it desires a quick start. In ordinary office buildings a speed of 150 feet to 350 feet per minute is attained. In some instances a load capacity of 2,500 pounds or 3,000 pounds is called for, but 2,000 pounds is perhaps more generally specified. Contracts quite often read as follows: The elevator shall be capable of lifting 2,000 pounds at a speed of 200 feet per minute. This means that the work to be done is equal to 2,000×200=400,000 foot pounds. This divided by 33,000, the foot pounds in one mechanical horse power, gives 12.12 as the horse power required. Now with winding drum machines it is possible to over counterbalance the weight of the car, and it is customary to do so. The counterweight may be applied in two ways. It may all be sustained by cables going directly to the drum, or it may be divided, part being directly sustained by the drum and part being attached to the cables, the other end of which is attached to the car (Figs. 2a and 2b). It is found to be good practice to over counterbalance the weight of the car to something like one-third or one-half the full load capacity. Suppose in the case above cited the counterbalance weighs 800 pounds more than the empty car. If an ordinary car weighs 1,700 pounds the counterbalance would be 1700+800=2,500 pounds. With an ordinary load of six or seven persons a balance would very nearly obtain. Usually, therefore, the power required to operate the elevator would be little more than enough to overcome the friction of the mechanism. A motor must be applied, however, which will raise the full 2,000 pounds at 200 feet per minute for some length of time if necessary. But since there is an over-counterweight of 800 pounds the actual or net load is 2,000—800=1,200 pounds. This, at 200 feet per minute, would require 1,200×200=240,000 foot pounds of energy, or 7.2 horse power approximately.

Experience has shown that for a worm geared wind-

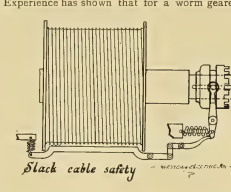



FIG. 9. SOME PROBLEMS IN ELECTRICAL ELEVATOR WORK.

ing mechanism with gears running in oil, the efficiency is about 50 per cent. Therefore, to exert 7.2 horse power the motor would need to be of 14.4 horse power capacity. Most motors will stand a 25 per cent. overload for a long time, so that some manufacturers would supply a motor of say 12 horse power to meet the above requirements. If the duty be heavy and constant, however, it would be better to put in a motor of fully 14 horse power.

OPERATING DEVICES.

The requirements are: Easy manipulation from the car and positive action for either direction of running. The forms most familiar to practice are hand cable, hand wheel, lever, push-button and pilot motor.

Combinations of these are sometimes used for the sake of increased safety. Freight elevators are generally equipped with hand cables, as by this means they are controllable from any floor of the building, no matter at which floor the car may be; and it is not usually necessary to get such an exact or gradual stop as with a passenger elevator. Furthermore, the cable device is comparatively cheap and easy to keep in adjustment (Fig. 3).

For passenger elevators the lever device seems to be most in use. This seems to be desirable because of its positive action, enabling the operator to know more surely where the up, down and off points in the controlling mechanism are. Several designs of lever devices are in use. Figs. 4a and 4b show two forms. Sometimes a cable and lever combination are supplied.

The push-button and pilot motor method is sometimes used, wherein a small motor, say of one-eighth or one-sixth horse power, is made to operate the main controlling apparatus, it, in turn, being controlled by a very slight current in connection with a system of push-buttons and switch in the car. This device should be supplemented by a hand cable in a corner of the car convenient to the operator.

The wheel method does not seem to be in very general use, though it may possess advantages by affording a long range of movement (Fig. 5). Engineers seem to prefer the lever device to any other form in most cases for passenger duty.

SAFETY DEVICES FOR THE CAR.

It is necessary that the car be supplied with such appliances that it may not drop to the bottom of the elevator shaft and cause damage. To guard against accident of this sort the car is generally supplied with a centrifugal governor which is arranged to release a powerful spring and apply a brake to the guide strips if the speed of the car increases much beyond the normal. This is called the governor safety. If the car runs between wooden guide strips there may be chisel edged cams or dogs which normally remain out of contact with the strips, but are so arranged as to be spitefully jammed into the strips by the action of the before mentioned spring when the governor releases it (Fig. 6a).

Another form is that called the Hultgren patent safety device, shown in Fig. 6b, where the governor cable is endless and travels with the car during normal conditions. The governor wheel is supported upon the cross beams at the top of the hatchway, and is so designed that excessive speed causes it to set a powerful clamp upon the governor cable holding it at rest. Then as the car continues to descend the action is to revolve the

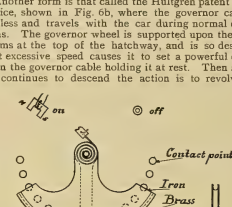



FIG. 10. SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

threaded shaft at the bottom of the car which, through a travelling nut and system of levers, applies powerful clamps to the guide strips.

If the guide strips are of iron a set of heavy iron clamps are brought into action by the releasing of a spring *a*, Fig. 7, by the movement of the point *b* downward.

The safety catches are sometimes at the bottom and sometimes at the top of the car. They should be placed at the bottom rather than at the top, for if the car was descending rapidly when the safeties came into action the car might become detached from them and keep on in its course.

In the case of wooden guide strips, if dogs are used, they should be so placed as to engage with the sides of the strips, rather than with their faces, because the guide posts and strips are liable to get out of plumb and then get unevenly distant from each other at different points, and thus destroy the adjustment of the dogs with relation to them. While if the dogs are adjusted to act at the sides their distance from the strip remains practically constant for all time, inasmuch as the wear and shrinkage are comparatively nothing.

Beside the governor safety an additional safeguard is supplied which obtains in the method of attaching the lifting cables to the car. While the car is supported by these cables a powerful spring is held in compression. If the cables get slack from any cause this spring is released and acts independently of the governor safety to

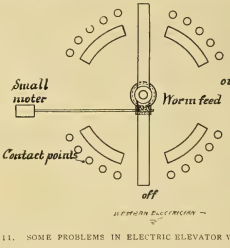



FIG. 11. SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

throw the dogs or clamps into action with the guide strips (Fig. 6a). These are usually all the safety appliances that are directly connected to the car.

SAFETY DEVICES FOR THE MACHINE

The requirements for either a winding drum or a traveling sheave mechanism are essentially the same, namely, that if the cables become slack, or if the current or power fail, the machinery will come to a stop. The writer will attempt to describe some of the safeties that are applied to winding drum machines only. Upon the drum shaft or positively driven therefrom is part of a fluted or jawed clutch which is free to move easily a short distance along the shaft upon a feather key, and is so set as to engage with its counterpart, which in turn is rigidly attached to the operating or stopping device. This clutch is held out of action usually by a forked lever and cam, or some equivalent method, while a strong spring that engages with the forked lever is held in confinement (Figs. 8 and 9).

Under the drum and almost touching the convolutions of cables is a bar or bars extending parallel to the shaft

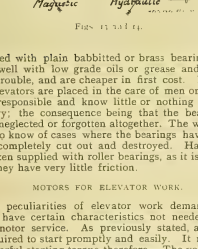
along the scored part. This rack or bar is pivoted and so overbalanced or sustained as to remain close to the cables while they are in tension, but is free to fall easily by a very slight pressure of the cables upon it. In falling it releases the powerful spring that holds the above mentioned clutch out of action, allowing it to engage with the operating device (Fig. 9).

The revolving drum brings this device to the "off" position, stopping the supply of current and applying the brake. So much for the breaking or slacking of cables. But suppose the current to fail while the car was moving. If the car was on the up trip with full load it would simply slow up and stop. If going up with little or no load the speed might accelerate, provided the car was very heavily over-counterweighted, and the machine had no emergency brake. But the automatic stops at top limit of travel would almost invariably suffice to prevent accident. Should the current fail while the car was descending with a heavy load, the speed would accelerate until the governor safety came into action, applying the dogs or clamps to the guide strips, slackening the lifting cables, and thus stopping both car and machine. All this could be prevented if the operator had sense enough to stop at the nearest landing. Or if the car was near the lower limit of its travel the automatic stops would act and avoid any disturbance of the safety appliances.

Some machines are supplied with an auxiliary brake that is held out of action by the current and becomes instantly applied when the current supply is cut off. This brake is often only powerful enough to gradually check the speed of the car, without absolutely stopping it.

BEARINGS.

Roller and ball bearings have been used for the drum shaft and for the overhead supporting sheaves. The ball bearing is now used in one type of electric hoisting device known as the hydraulic type, the balls being applied between the surfaces of the screw and its traveling nut (Fig. 1). Where high efficiency of bearings is essential to the successful working of a machine, the roller or ball type takes the lead. But they are more expensive, both in initial cost and maintenance, and so most elevators are




Figs. 13 and 14.

supplied with plain babbitted or brass bearings, which work well with low grade oils or grease and give very little trouble, and are cheaper in first cost. Most electric elevators are placed in the care of men or boys who are irresponsible and know little or nothing about machinery; the consequence being that the bearings are often neglected or forgotten altogether. The writer happens to know of cases where the bearings have run dry until completely cut out and destroyed. Hand hoists are often supplied with roller bearings, as it is desirable that they have very little friction.

MOTORS FOR ELEVATOR WORK.

The peculiarities of elevator work demand that a motor have certain characteristics not needed in ordinary motor service. As previously stated, an elevator is required to start promptly and easily. It must have a powerful starting torque therefore. The voltage upon power circuits is apt to vary greatly under changing loads, so that a motor must be adapted to wide variations of voltage. The company which is supplying current demands that the first rush of current and the starting current be as small in amount as possible in any given case. This is particularly true where elevators are run off circuits that are supplying incandescent lights. Nearly all motors used for direct coupled elevator machines are of the low-speed type, varying between 500 and 800 revolutions per minute, the usual speed being between 600 and 750 revolutions per minute. This, of course, is therefore the speed of worm shaft.

STORAGE BATTERY AUXILIARY.

To counteract the effect of the first rush and starting current of a motor that is accelerating its full load, a battery of storage cells has been thought to be a valuable adjunct. Many electric railway plants, the service of which is similar to that of elevators, have tried them, and they have been well reported of as helping out the generating plant during heavy demands for current. While the car service was light they would be taking current from the generators, and thus they would act as a sort of balance wheel to the plant. The application of storage cells to electric elevator plants has been thought by some to be equally advantageous, inasmuch as it is next to impossible to start an elevator and bring it to full speed quickly without drawing heavily upon the supply of energy, no matter if the motor and controlling method possess the highest efficiency obtainable. Assuming that this heavy demand for current cannot be avoided, some method of storing energy to counteract its effect is desirable. This would especially hold true where the generating plant was small relatively to the amount of power required for the running of elevators. The addition of such an auxiliary, however, would entail a large first cost, and considerable expert attendance would be needed in the proper care of the plant. The circumstances in any particular case

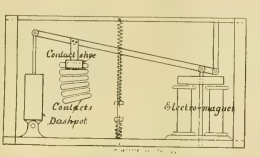



FIG. 12. SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

would have to be carefully considered, therefore, before installing such a plant.

CONTROLLING DEVICES.

The simplest form of electric elevator, as before stated, is one in which a motor drives a countershaft, this in turn being connected by straight and crossed belts to a worm geared elevator machine. The controlling apparatus for such a machine would be a simple line switch and hand rheostat, the motor being started first and brought to full speed. The car is then operated by the shifting of the two belts from idler pulleys at either side onto a center or working pulley keyed to the worm shaft. This movement also releases the brake. This device allows the use of ordinary high-speed motors having

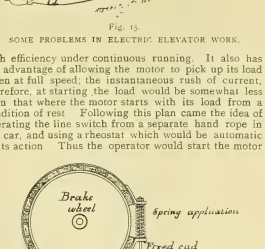



Fig. 15.

SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

high efficiency under continuous running. It also has the advantage of allowing the motor to pick up its load when at full speed; the instantaneous rush of current, therefore, at starting the load would be somewhat less than that where the motor starts with its load from a condition of rest. Following this plan came the idea of operating the line switch from a separate hand rope in the car, and using a rheostat which would be automatic in its action. Thus the operator would start the motor

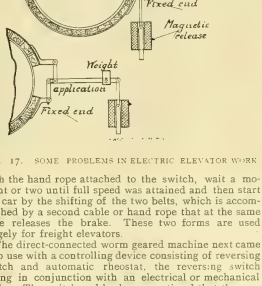



FIG. 17. SOME PROBLEMS IN ELECTRIC ELEVATOR WORK.

with the hand rope attached to the switch, wait a moment or two until full speed was attained and then start the car by the shifting of the two belts, which is accomplished by a second cable or hand rope that at the same time releases the brake. These two forms are used largely for freight elevators.

The direct-connected worm geared machine next came into use with a controlling device consisting of reversing switch and automatic rheostat, the reversing switch acting in conjunction with an electrical or mechanical brake. The switch and brake are so timed that the current is broken just a little before the brake is applied, and the brake is released just a little before the current is admitted to the machine. With this device the motor starts and stops with the car, and in most cases the current is entirely shut off from the machine while the car is at rest. In some instances however, the current is only broken from the armature circuit, the field current being kept on constantly.

Another method of control is by using a specially wound motor together with reversing switch and an auxiliary commutating switch that takes the place of the customary rheostat. The fields of the motor are wound so as to give a very strong degree of magnetization at the start, and the speed is gradually obtained by a weakening of the field strength through some method of commutation.

AUTOMATIC RHEOSTATS.

The operation of cutting out resistance has been accomplished by several means, some of which are as follows.

By a worm and worm wheel running from motor or line shaft, the worm being thrown into gear by an electro-magnet as soon as the line switch is closed and being released by a weight or spring; by a small motor running a worm and wheel, the motor starting as soon as connection is made to the line; by electro-magnets or solenoids with keepers or plungers connected through levers to the movable contact brush or arm, the rate of cutting out resistance being regulated by dash-pots, the cutting in being performed by the falling of the keeper or plunger; by means of hydraulic action, using a plunger in a cylinder and admitting water above and below through different sized apertures, thus giving a slow movement for cutting out, and a rapid movement for cutting in the resistance (Figs. 10, 11, 12, 13 and 14).

Some of the defects most noticeable in these methods are as follows:

The form shown in Fig. 10 is positive in its action, and the rate of cutting out resistance depends upon the rate at which the motor gains its speed; that is, if the motor has to start with light load, or no load, the speed will be gained more quickly than with full load. This causes a gradual and more nearly uniform rush of current at starting with varying loads than some other methods allow of, and is therefore worthy of careful

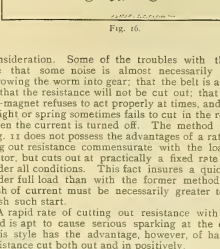



Fig. 16.

consideration. Some of the troubles with this form are that some noise is almost necessarily made in throwing the worm into gear; that the belt is apt to slip so that the resistance will not be cut out; that the electro-magnet refuses to act properly at times, and that the weight or spring sometimes fails to cut in the resistance when the current is turned off. The method shown in Fig. 11 does not possess the advantages of a rate of cutting out resistance commensurate with the load of the motor, but cuts out at practically a fixed rate of speed under all conditions. This fact insures a quicker start under full load than with the former method, but the rush of current must be necessarily greater to accomplish such start.

A rapid rate of cutting out resistance with a heavy load is apt to cause serious sparking at the contacts. This style has the advantage, however, of having the resistance cut both out and in positively.

The plans shown in Figs. 12 and 13 have the advantage that the rate of cutting out resistance is proportionate to the load upon the motor, inasmuch as the current in the electro-magnet is greater or less, as the speed of the armature of the motor is lesser or greater, this being due to the action of the counter electromotive force of the armature.

The type shown in Fig. 14 has been used for freight elevator service, and would work very nicely so long as the water pressure remained practically constant, and the temperature of the room in which the machine was placed remained slightly above the freezing point.

OPERATING SWITCHES.

About the most simple form of operating switch used is a simple reversing switch which serves to reverse the current in the armature of the motor, the fields being connected to the line switch permanently, so that the current remains in them during the hours of running the elevator (Fig. 15). A double-throw double-pole knife switch on the same shaft with the main controlling device is attached, which makes contact with the line, field and armature terminals on the two sides, the armature terminals being crossed for reversal, is often used (Fig. 3). The double-ended lever-switch is sometimes used, and may serve to make the connections to both armature and field, Fig. 11. Still another type is that where double disks are fastened upon separate insulated arms,

[Continued on page 274.]

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CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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## HIGH WATER MARK
CIRCULATION, 16,630.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

| Date. | Number of Advertising Pages. | Total Number of Pages. | Square Inches of Paid Advertising Matter. |
|---|---|---|---|
| March 3, 1894.... | 46 | 50 | 4,145 |
| February 23, 1895 | 52 | 68 | 5,593 |
| May 9, 1896..... | 72 | 88 | 7,576 |

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

COMMISSIONER OF PUBLIC WORKS KENT recently announced his determination to retire from the service of the city of Chicago in order that he might devote his entire attention to commercial enterprises, one of which at least had the city for a customer and conducted its dealings through the department over which Mr. Kent presided. Here is an excellent example for John P. Barrett to emulate.

ONE of the best illustrations of the benefits of advertising is presented in the electrical exposition of New York, which has been attracting such great throngs all this month. Can anyone doubt that the great success attained by the management was largely due to the aid received from newspaper advertising? This exhibition should impress the gentlemen who participated in the show either as exhibitors or managers or visitors with a proper appreciation of the power of the press.

THE publication of sensational charges against men of prominence in the profession is a serious matter even for an obscure journal to engage in, and cannot fail to bring those responsible for the circulation of such an unwarranted attack into disrepute. An abject apology will not suffice, especially where the "thorough examination of the circumstances" that satisfied the writer of the libelous article "that he was entirely mistaken," after suit had been threatened, might have been made before the publication of the article in question. It is impossible to find any justification for such proceeding.

THE next great event of the year for electrical men is the convention and exhibition of the American Street Railway association at St. Louis in October. The secretary's announcement is presented on another page, and those who intend to participate in the benefits of this great gathering of street railway magnates would do well to make their preparations early. This gathering, like former meetings of the organization, will possess unusual interest for men who make and sell apparatus for use on electric street railways. The membership of the organization is largely composed of companies using the trolley system, and this number is constantly growing. The meeting will be held in a city depending upon the overhead trolley system for transportation, and those who are at all skeptical will there find convincing argument favorable to this much abused institution.

IN all large cities electric elevators are being introduced in office buildings and big institutions of various kinds. There are several types of apparatus now on the market that are meeting with favor by builders of elevators, some of these differing widely in design and others only in minor details. With enlarged experience in operation we may look for still greater modification, even though the present state of development affords such superiority in service as to command the attention of architects and builders. In simplicity, efficiency and economy the electric elevator presents advantages over other types. But there are many details that may be modified and improved, and to these engineers are devoting attention to-day. Mr. Cochrane's paper on "Some Problems in Electric Elevator Work," presented on another page of this issue, gives the views of one who is engaged in this work. His experience has given him excellent opportunity to study this subject in all its bearings and places him in a position to speak authoritatively upon it.

THE experience of the elevated railroads of New York should prove valuable to every corporation depending upon public patronage for support. The statement of the Manhattan company for the quarter ended March 31st showed that the number of passengers on the elevated roads during those three months was more than twelve hundred thousand less than during the corresponding period of the previous year, and nearly four millions less than during the first three months of 1894. The Manhattan company had enjoyed a practical monopoly of the transportation business for the territory which it occupied, but the service was very unsatisfactory, the accommodations were wretched, the cars were poorly lighted and not properly cleaned, and the patrons clamored loudly for improvements and extensions, but to all these demands the "L" company turned a deaf ear. The cable company then stepped in with extended surface lines and increased facilities. The result appears in the enormous falling off of traffic on the elevated roads and the marked decline in the value of Manhattan stock. And now the "L" company finds itself compelled to consider means for regaining this business, which it lost through failure to provide suitable accommodations. Had it taken the precaution to retain this patronage the present situation would not exist. Other corporations should take warning. Some of those now enjoying valuable franchises in Chicago may have similar experience unless a change is made.

VERY few inventions have created the stir in the scientific and commercial world that has followed the announcement of Dr. Jacques, that he had designed a carbon electric generator by which electrical energy could be converted directly from coal and 10 times the quantity now obtained be secured. The inventor, who, by the way, is reputed highly in scientific circles, says: "I have discovered that if oxygen, whether pure or diluted as in air, be caused to combine with carbon or carbonaceous materials, not directly, as in combustion, but through an intervening electrolyte, the potential energy of the carbon may be converted directly into electrical engery instead of into heat." The apparatus used to accomplish this and the process employed ware described and illustrated in the last issue of this journal. Speaking of this matter, Professor Cross said that he had for many years been acquainted with the attempts to derive electrical energy directly from the oxidation of carbon, and had known, as had every other person who had considered the subject, that heretofore none were in any way available for actual service for any industrial purposes whatever, even on the smallest scale. They had been interesting scientifically, but by their ineffectiveness had served only to make the solution of the problem seem even more distant. His examination of Dr. Jacques' discovery, however, leads him to anticipate remarkable results in this line. Professor Rowland, who has also experimented with Dr. Jacques' invention, adds his influential indorsement to the value of the discovery. The subject will doubtless receive close attention and the commercial value of the process determined beyond question.

AGAIN the daily papers of Chicago are forced to take notice of the wretched street lighting service provided under the supervision of John P. Barrett. The *Chronicle*, which heretofore has looked with considerable leniency upon the failings and shortcomings of the "professor," is at last constrained to call attention to the inefficiency of that department. In an editorial on "Poor Arc Lighting" our contemporary says:

> Complaint is made of the poor service given by the city electric lighting system, especially in the West Division
>
> The system has been extended as rapidly as possible to supplant gas. Such extension is desirable because the arc is preferable light to the gas jet. But if it is extended so that in effect there is no light at all, it is preferable to have the street lamp with the old illuminant.
>
> Nothing of thorough utility and economy can be expected under municipal operation in this or any other direction where competition with private enterprise is inevitable until there is fully grafted on the city administration the merit system.
>
> Political henchmen, ward heelers, fellows with political pull, are experts in the drawing of municipal pay, but when they are called upon for genuine work in competition with skilled, industrious operators in private enterprises they fall down completely.
>
> All of which is very true. Let the work of reform begin at the top and extend all the way down the line. As long as we continue the municipal system which has been saddled on the city of Chicago by that eminent "expert in the drawing of municial pay," who is at the head of the department, let us have an efficient administration. Put an electrical engineer in the office of city electrician—someone of commanding ability and experience in electrical work, who will devote all his time to the city's service and not engage in outside enterprises. When the head of the department is capable, energetic and jealous of the city's interest it may reasonably be expected that subordinates will be correspondingly attentive to their duties. Thus the evils of a municipal service will be reduced to a minimum. The office should be filled by an electrician, not a politician.

## Niagara Power Transmission, the Electrical Exposition and Mr. Johnston's Libel Suit.

It is to be regretted that the holding of the National Electrical Exposition at New York and the remarkable demonstration of the transmission and application of electricity from Niagara Falls to the exhibition were attended by an unpleasant incident which cannot fail to detract from the general good feeling that has prevailed up to the present time. An eastern publication, the *Electric Railway Gazette*, published an editorial under the title "Transmission of Power Extraordinary," in which it pronounced the exhibition of the model of the Niagara Falls power plant operated by current from the Falls a "fake" and seriously reflected upon the gentlemen who were identified with the project. The article had the effect of creating a sensation and brought the hitherto obscure publication into prominence. The management of the exposition was naturally indignant at the outrageous charges, and the gentlemen who had planned and executed the project issued statements in which they flatly denied the accusation. Their personal and professional reputation alone should have protected them from even an insinuation of trickery or fraud. T. C. Martin, with whom the scheme originated, made the following statement:

For nearly a year past I had believed it possible to deliver Niagara energy over wire at the exposition, and some months ago set out to do it by securing a small model of the Niagara power plant to begin with, then permission from the Niagara Falls Power company to connect with the power house, Tesla apparatus from the Westinghouse Electric & Manufacturing company for the transmission to the model, two wires from the Western Union Telegraph company, and wires from the American Telegraph & Telephone company (long-distance telephone) to transmit the roar also to the model. The plan has been, to my positive knowledge, carried out, as I have personally watched the accomplishment of my plan. The electrical engineers coöperating have been A. S. Brown of the Western Union company, Nikola Tesla, L. B. Stillwell of the Westinghouse company, assisted by Messrs Maclaren and Zimmerman and F. A. Pickernell of the Long Distance Telephone company. I would add that as the Western Union wires are available only in the evening, I carried out the suggestion of A. S. Brown of sending storage batteries to Niagara to be charged; so that the model could also be run in that way for the benefit of daytime visitors, who might otherwise be disappointed. This difference of method in daytime and at night has been carefully explained in labels and printed statements, so that there could be no doubt or misapprehension as to the facts. The Niagara transmission over Western Union wires has been a great success, doing far more than was expected. In fact, failure was freely predicted by many.

In addition to the foregoing statement a card was prepared by L. B. Stillwell of the Westinghouse company, in which that gentleman said:

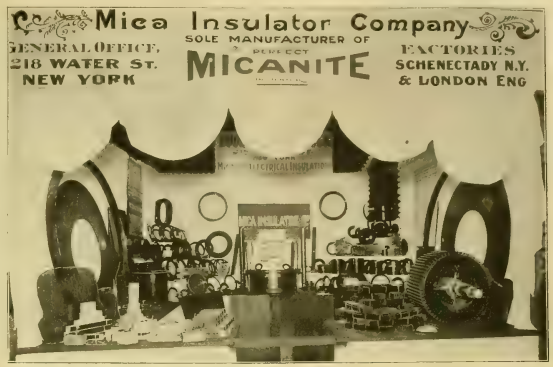
The power used to operate the small Tesla motor at the electrical exposition comes from Niagara. During the evening it is transmitted over a circuit consisting of three conductors. Two of these are wires ordinarily used for telegraphic purposes by the Western Union Telegraph company. The third is the earth. In technical language, it is a case of tri-phase alternating current transmission. For a time direct or continuous current was used. When the alternating current is in use the potential as measured across any two conductors at the Niagara end of the line is approximately 500 volts. The currents are delivered to the exposition building at a potential approximating 250 volts. The gentlemen in charge of this undertaking have accomplished precisely what they undertook to accomplish, and the transmission is an unqualified success.

The following announcement was officially made by the exposition management:

The National Electrical Exposition company, through its counsel, J. G. Wells, on Saturday, May 23d, brought suit in the Supreme Court against the W. J. Johnston company, publisher of the *Electric Railway Gazette*, and *Electrical World*, for $50,000 damages for libel, the suit being based upon an article in the last issue of the first named paper, charging that the exhibition of Niagara power transmission at the electric show is in the nature of a "fake" and "gigantic fraud" upon the public. The officers of the National Electrical Exposition company are: H. J. Smith, general superintendent of the Edison Illuminating company of New York; W. F. Weiss, vice-president of the New York Steam Heating company; George F. Forter, secretary of the National Electric Light association; C. O. Baker, Jr., of the Baker Platinum Refining company; R. B. Corey, General Incandescent Arc Light company; H. L. Lufkin, Crocker-Wheeler Electric company, and E. F. Peck of the Peck Electric company.

A letter was also issued, signed by "W. J. Johnston, editor *Electric Railway Gazette*," of which the following is a copy:

In the *Electric Railway Gazette* of May 10th appeared an item, written immediately after the opening of the electrical exposition, saying that the success of the experiment in the transmission of electric power from Niagara to New York savors strongly of "fake." The author of the paragraph believed at the time that he had grounds for making the assertion. He has since made a thorough examination of the circumstances, however, and satisfied himself that he was entirely mistaken in what he said, and a correction will be made in the next issue of the *Gazette*, dated May 25th. I need not add that both the author of the item and I regret the appearance in an electrical journal of anything that might be construed as a reflection upon the good faith of the well-known companies and gentlemen to whose efforts are due the success of the Niagara transmission.




MICANITE AT THE EXPOSITION.

## Micanite at the Exposition.

The exhibit of micanite at the New York electrical exposition by the Mica Insulator company, shown by the accompanying picture, is sure to appeal to all who are interested in high-grade insulation. Not only the standard shapes of rings, segments, cylinders, tubes, troughs, spools, washers, cloth, etc., are displayed, but also several special shapes which show the adaptability of micanite to be shaped to any form desired. Among these special forms are two large V-shaped rings five feet in diameter, micanite insulation for pole pieces, a large armature and several commutators insulated completely with micanite.

The exhibit is in charge of C. W. Jefferson and Edward C. Wood. Eugene Munsell & Co. have space with the Mica Insulator company and exhibit mica in the rough, as obtained from the mine, and also after it has been prepared for use. They also show stamped solid sheet mica segments, washers, rheostats, etc., and are prepared to furnish mica in any quality, size or pattern, in the rough, or cut to shape. The exhibit is in charge of Edward C. Wood.

REISINGER'S DISPLAY OF CARBONS AT THE EXPOSITION.

## Reisinger's Display of Carbons at the Exposition.

Hugo Reisinger, 38 Beaver street, New York, is exhibiting the celebrated Electra high-grade Nuernberg carbons at one of the handsomest and most attractive booths at the New York exhibition, as may be judged by the accompanying illustration. The exhibit cases are decorated in white and gold and call forth flattering comments from visitors. Among the splendid display of carbons, one sees those for direct and alternating current lighting, searchlights and all kinds of carbons for telephone construction, batteries and smelting purposes.

It is stated that the factory in Europe is one of the oldest and largest there, and the Electra carbons have not only gained a world-wide reputation, but, through their fine and uniform quality, are recognized as the standard for constant potential and alternating current arc lighting. J. F. Outwater, who represents Mr. Reisinger at the exhibition, has, by his affability, made many

friends. A pretty memorandum book is given away as a souvenir, in which the electrical trade is invited to give the Electra carbon a trial, while two interesting tables, which form a part of the exhibit, compare the life of the Electra carbon with others, and also the weight of dust produced by it and other makes, both imported and domestic.

## Wire and Cable Exhibit.

An attractive an interesting display at the exposition is found in spaces 14-17, section A, main floor, where the Washburn & Moen Manufacturing company exhibits cables and wires. Besides a general exhibit of all kinds of wires for lighting and railway purposes, the glass cases which line the walls contain samples of bare, high-grade copper wire. Among these is a copper wire .0025 inch in diameter; 10½ miles of it only weigh a trifle over one pound. The well-known "Crown" wire, lead-covered for underground purposes, is also shown.

This company has on exhibition a section of the main feeder wire supplying current in the exposition building, and having cross-section of 2,000,000 circular mils. A still larger one, 2,790,000 circular mils in section, is also manufactured, and is said to be the largest single electrical conductor in use in this country. One case contains a large number of steel models illustrating the wires of irregular shapes made by the company.

There are also shown electric railway materials, the new eight-section trolley wire, and a reel of 500,000 circular mils cable for street railway work, which is both weatherproof and lead-covered. Another prominent feature is the Chicago rail bond which has been adopted by many leading railroads, and also a handsome assortment of lamp cord, office, annunciator and magnet wires. The exhibit is in charge of C. W. Bassett, H. C. Willis and D. P. Fitzgerald, Jr.

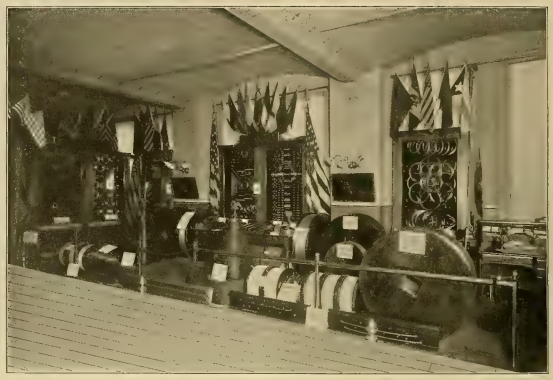
## The Situation in Milwaukee.

[From the Milwaukee correspondent of the WESTERN ELECTRICIAN.]

One more attempt was made to settle the street railway strike last week, this time a number of Republican officials and politicians taking the matter in charge, but, like all former efforts, it failed. Their reason for the step was that Henry C. Payne and Charles F. Pfister, being very prominent in the councils of the party and being leaders in the management of the street railway as well the strike, with its attendant boycott, which is hurting the business of the city was a menace to the Republican party itself.

The worst phase of the strike is the indirect boycott. The people generally are not riding in the street cars, a large proportion because they sympathize with the men, but others are actuated by fear, for merchants who patronize street cars are boycotted. The First National Bank is boycotted because Messrs. Payne and Pfister are directors of it, and those who sell supplies to the company are also under the ban. The company is boarding its men at various stations along its line, the men sleeping in car barns, and the company, being unable to obtain groceries and provisions for the men in Milwaukee, sent to Chicago for supplies.

The plan of municipal ownership of street railways is spreading. At a meeting of delegates from the various Turner societies of the city and from other societies, resolutions in favor of a special session of the Legislature for the purpose of coademning the property of the street railway company were adopted. The resolutions also provide that the people of the city shall organize a stock company, with shares at $5 each, the city to become a shareholder for the full amount for which it can issue bonds under the bond limit, the company to enter into a contract with the city that all profits which it may earn in excess of 6 per cent. shall go into a sinking fund, of which the city shall be trustee, for the purpose of buying the stock of the private shareholders as soon as the sinking fund is large enough, the idea being that the city shall in time become the undivided owner of the street railway lines.



WIRE AND CABLE EXHIBIT.

GORDON-BURNHAM BATTERY EXHIBIT.

## Tribute to Dr. Franklin.

Only those who have attempted to write a biography have any idea of the difficulties that attend such an undertaking. That the requirements of a task of this character are of an unusual and exacting nature is shown by the very small number of really meritorious works of this description and the large proportion of worthless compilations that find their way into print. It is, therefore, with no little pleasure that one finds in the sketch of Benjamin Franklin by Joseph Medill, recently published by the Ben Franklin company of Chicago, an appreciative review of the life and character of this great man, who is termed by the author "a typical American." One would naturally expect from Mr. Medill an unusually interesting story, because of the great admiration of the veteran editor for this great historical figure, and one is not disappointed. The work is really a tribute to the memory of Franklin, and the reader cannot but feel regret that a more elaborate treatise was not undertaken. The publisher evidently appreciated this fact, for in an introductory note he says that the work has but one fault, it is too brief to do full justice to a life so useful and noble as Franklin's. The author says: "I have tried to crowd into a small space enough to show what a wonderful man Franklin was; how many-sided or multifold his mind was; how nearly an universal genius he was; to show that his was a great mind in many directions. I wish to have the pamphlet tell enough about him to arouse curiosity on the part of young men which will cause them to read more about this remarkable man." One cannot read this excellent work without feeling considerable pride in this great American. Accompanying the sketch are several excellent reproductions of celebrated portraits of Franklin made at different periods of his life, and also a picture of "Franklin Before the Lords in Council, 1774."

## Gordon-Burnham Battery Exhibit.

The most casual visitor to the exhibit of the Gordon-Burnham Battery company at the New York electrical exposition cannot fail to have the merits of this battery impressed upon him, as may be judged by a glance at the picture on page 000. The company, which has an office at 82 West Broadway, New York, claims that the Gordon primary battery excels in long life, efficiency, economy, adaptability, non-freezing and labor saving qualities, freedom from local action and from gases and odors, as well as a superior generation of energy

## Notes from the Exposition.

From present indications it seems likely that the Exposition company will declare a handsome dividend, and some place the figures as high as fifteen or twenty thousand dollars.

General Superintendent Frank Stevens of the Electric Protection company of Philadelphia spent two days of last week in attending the electrical exposition. He reports that business is brisk with them, promising a large increase over last year.

J. H. Gibson, electrician of the Baltimore City Passenger Railway company, was a visitor at New York last week. He expressed himself as surprised at the fine

showing at the electrical exposition, and said that the results would materially help the industry and give a better idea of its importance to all classes of people.

B. J. Arnold of Chicago spent several days of last week in New York, and was a frequent visitor to the exposition. Mr. Arnold's primary object was to read a paper before the Institute on the interesting Board of Trade plant in Chicago, of which he is engineer, but incidentally he answered a good many inquiries in relation to the Arnold power station system

There can be no doubt that much of the success of the exposition is due to the intelligent and attractive advertising and descriptive announcements furnished to the daily and technical press. The press bureau was happily placed in charge of a well equipped newspaper man, B. B. Greene, late of *Electricity*, and the results of his well directed and indefatigable efforts are now seen.

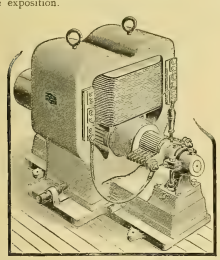
An attractive reminder of the exposition, and an excellent bit of advertising material as well, is the handsome

NEW GENERAL ELECTRIC FAN MOTOR.

pamphlet issued by W. Goldstein, manufacturer of boiler scale eradicator, at 630 Water street, New York. This pamphlet bears a resemblance to a catalogue of the exposition, but closer inspection shows that it is given up to an exploitation of the merits of Mr. Goldstein's preparation.

First Lieutenant George Owen Squier, United States Army, has been detailed to spend two weeks at the exposition to gather such data as will be of use to the government. Lieut. Squier is much astonished at the large and complete display made of the various branches of the electrical business, and pronounces the show to be in many respects superior to previous exhibitions that have been held in this line.

Col. A. E. Jones and John A. Mason find their time fully occupied in explaining the detail of the Morrin boiler at the Clonbrock steam boiler headquarters. It is pleasing to note that they report that several orders have been taken and the prospects are bright for the closing of others soon. General Manager S. V. Morrin gives his personal attention to this company's business at the exposition.



There is probably nothing which is attracting more attention among the booths at the exposition than the exhibit of the Ball Bearing company of Boston, which comprises a large variety of applications. The frictionless quality of the bearing is seen when one handles the parts and turns the journals upon the bearings. Steel balls of all sizes, even down to $\frac{1}{32}$ of an inch, are displayed. General Manager N. S. McGowan, assisted by J. A. Morton, is in charge.

The exposition knows no busier man than Professor L. B. Marks of the Electric Arc Lamp company, whose invention of the Pioneer inclosed arc lamp is so well known in the electrical business. Prof. Marks is assisted by a number of experts in presenting the merits of this lamp to the many central station men and purchasing agents who have expressed an interest in the Pioneer.

The absence of shadows from the globes and the steadiness of the light excite general and favorable comment.

The exhibit of H. B. Coho & Co., New York agents of the Eddy Electrical Manufacturing company, is still one of the features which attracts the attention of the visitor on the ground floor. The Eddy generators have carried an extremely heavy overload ever since they were installed, and have received very favorable comment because of the splendid manner in which the machines do their work, showing that their rated capacity is much below the average consumption as indicated by the test readings.

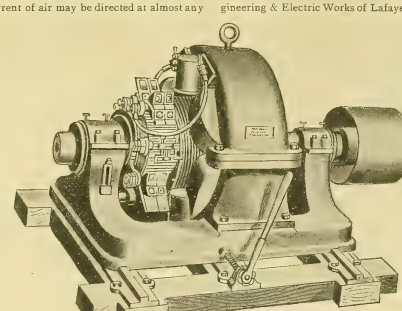
The ingenious X-ray circular distributed by the New York Electrical company, which is located very near this popular resort of the exhibition, was in such demand that the supply was soon exhausted, and renewal orders were given for large quantities. The specialties shown by this firm are those which are not seen elsewhere in the exposition hall, and the line of electrical novelties, such as door openers, watch case receivers, baby knife-switches, midget pushes and various telephone devices makes up an interesting display.

The Partridge Carbon company of Sandusky, O., shows a spendid line of self-lubricating generator and motor brushes on what is known as the X-ray floor of the exposition. Secretary and Treasurer J. S. Spier has been in attendance as much as he could, although he depends much on Harry M. Shaw, the eastern agent of this company, to take charge of the exhibit. Mr. Shaw reports that he has made many sales, and, from present indications, his business will show a very large increase for this month over last. The high grade of the Partridge brushes is well known, and the company deserves the success which it is receiving.

The extensive exhibit of the Electric Storage Battery company was added to on Saturday evening, May 16th, by the installation of apparatus showing the formation of storage battery plates by the Planté process. In a glass jar filled with electrolyte, two lead plates were immersed, the terminals being connected to a battery of chloride accumulators. Through a large magnifying glass placed in front of the jar, the action of the current on the lead was plainly discernible. It proved an interesting feature to the crowd which watched it during the evening. The electric launch in the company's exhibit had a captain on Saturday evening in the person of a very small colored boy dressed in a "middy's" uniform of white duck and with the words "Chloride Accumulator" on the front of his sailor hat. Chloride accumulators furnished the current to operate the telegraph instruments that started the messages around the world, and also for firing the guns that announced the departure and arrival of messages.

## New General Electric Fan Motor.

The '96 model alternating current fan motor of the General Electric company, represented in the cut, embodies many improvements. Perhaps the most important of these is the universality of direction which can be given to the draft caused by the revolving blades. As the motor field frame is provided with trunnions resting on a yoke, the current of air may be directed at almost any angle in a vertical plane, while at the same time the yoke is so set in the base that the motor may be moved through a complete circle horizontally and the current be directed toward any point as desired. The yoke may also be removed from the base and inserted in a wall bracket. The design of the motor is both simple and ingenious. The field is a ring built up of thin iron punchings with inwardly projecting teeth carrying the field wiring. The armature is a cylinder of iron laminations, with small bare copper rods running through the iron and terminating in copper disks fastened at the end of the core.

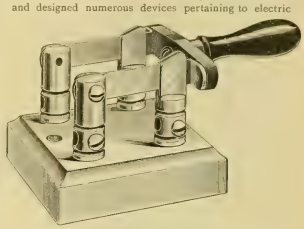


FIGS. 1 AND 2. LAFAYETTE DYNAMOS AND MOTORS.

This fan motor is wound for either 104 or 52 volts and for frequencies of either 60 or 125 cycles. The complete device is artistic in design, well proportioned and handsomely finished, the fan and guard being nickeled and the motor, yoke and base black japanned. The diameter of the fan is 12 inches and the speed 1,800 revolutions per minute.

## Ball Switches.

The H. F. Ball Manufacturing company of New York is a new company organized to construct electrical appliances of all kinds, but more particularly switches, switchboards and appliances of that nature. Mr. Ball, the president of the company, has had considerable experience in the designing and constructing of electrical appliances of this kind, having been in the electrical field for about 10 years, his connection being principally with the General Electric company and the Carpenter Rheostat company. While with these companies he invented and designed numerous devices pertaining to electric lighting and the transmission of power which are in use to-day. He has been granted many patents pertaining to the work that his company is now taking in hand. The company is making a special drive on baby switches, which are the largest of this class on the market, having a capacity of 35 amperes. The accompanying cut shows the general appearance. The parts are nicely polished and lacquered, and mounted on a hard vitrified porcelain base that can be wired back or front. There are numerous details in construction in this switch which are said to make it superior to others on the market. Correspondence is solicited, and any information will be courteously and promptly given from the New York office, 101 Beekman street.



BALL SWITCHES.

## Lafayette Dynamos and Motors.

The dynamos and motors made by the Lafayette Engineering & Electric Works of Lafayette, Ind., are meeting with deserved success. Two types are herewith illustrated.

Fig. 1 shows this company's ordinary bipolar motor, but this machine can be readily changed into a dynamo by adding a small series coil which is form wound and placed in the lower part of the magnet. The magnet is one solid steel casting, simple and symmetrical in design. It is constructed in this manner in order that the bearings may be as low as possible, thereby rendering the machine free from vibration. The steel is composed of a special mixture which permits of a high degree of permeability. It is generally acknowledged that the steel castings now furnished by several steel

companies are superior to wrought-iron for magnets, and when it is considered that with wrought-iron there are usually several joints across the magnetic circuit, it is seen how desirable a steel magnet is without joints of any kind.

The field coil is placed above the armature, tending by its magnetic relations to the latter to relieve the bearings, to a considerable degree, of their strain while under load. The coil is wound in three sections, as this method has many advantages not possessed by any single coil. In addition to the more perfect insulation obtained, the sectional field offers greater facility for repairs. It frequently happens that an entire field spool must be removed and unwound to find and repair a single defect. With the sectional field the fault can readily be located and another section substituted, or, if the machine is not too heavily loaded, the defective section can be cut out until a convenient opportunity offers for rewinding the coil.

The armature is of the well known Siemens type slightly modified in winding. It is built of soft wrought-iron in thin disks, thoroughly shellacked on both sides; to provide for further insulation, a layer of varnished canvas is placed at frequent intervals. The commutator is of heavy and substantial construction and is built of tempered copper especially made for this class of work. Great care is taken with the insulation, and only the very best India mica is used. The boxes are fitted with self-oiling spherical bearings made of the best phosphor-bronze, provided with sight oil gauge. Either carbon or copper brushes can be used as desired. In general the machines are so designed as to operate as far as possible without attention and without sparking. They are compounded for any per cent. drop, but unless otherwise specified they are adjusted to provide for a drop of three per cent. at full load. They are of moderate speed, permitting of large diameter of pulley, giving ample belt service. The machine as a whole is built of the best material; all parts are made to gauge and interchangeable.

The company is also bringing out a line of slow-speed multipolar dynamos and motors, which have been designed with a view of obtaining a very efficient machine, which may be either belt driven or connected directly to the shaft of a steam engine. As will be seen from Fig. 2, great care has been taken to produce an artistic design, a solidity of construction and a close adjustment in electrical proportion.

The armature, except in the smaller sizes, is of the toothed type, but has several important modifications in its details. Each coil is independent of the other; this allows the replacing of an injured coil, in case of accident, with but little delay and trifling cost. These coils are wound separately on forms and can be furnished complete ready to be placed on the armature. Both armature and commutator are thoroughly ventilated, and the fields have a large radiating surface, so that the heat is readily dissipated. The field coils are also wound separately on suitable forms, and are held a short distance from the pole pieces so as to allow for an air space to ventilate the inner surface of the spool.

The magnet frames and pole pieces are cast from a special soft steel of high magnetic qualities and bolted to a heavy cast-iron base thoroughly braced and proportioned to absorb vibration.

Especial attention has been given to the commutator, which presents a large and ample surface for the brushes, and permits any variation of load without sparking. The brush holders are mounted upon a rocker arm and may be shifted simultaneously upon the commutator face; at the same time they are so constructed that each brush has an independent adjustment of tension and position

The pillow block standards are cast with the base and are provided with long spherical bearings, furnished with hard bronze linings which are self-aligning and ring oiling.

These multipolar dynamos are compound wound and are ordinarily arranged to maintain a practically constant potential. The insulation throughout is of the best, pure India mica and varnished cloth being used in all the work, thus insuring high spark-resisting qualities with great strength and durability. The slow-speed motors are similar in construction and appearance to the dynamos, and by changing the field coils the motor can be altered to a generator for lighting or power purposes, or *vice versa*.

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The Legislature of Ohio has enacted a law adopting the electric method of executing criminals, the new statute to take effect July 1st.

## Some Problems in Electric Elevator Work.

[*Continued from page 269.*]

and in revolving about a center, make contact with the terminals of armature, field, line and accessory electro-magnets, etc., belonging to rheostats or special devices (Fig. 16).

Another form sometimes used is a cylindrical, or so-called barrel switch, there being metallic contact rings separated by insulating material, but fastened rigidly upon a shaft. These contact rings are so spaced and of such a given length of arc as to make the proper connections with the terminals of line, field, armature, etc., which terminals in turn are stationary. This form is that in general use for street railway equipments.

There may be many other forms besides the ones mentioned, but these are the most important ones known to the writer.

CIRCUIT BREAKERS.

It is desirable that all electric power apparatus be supplied with magnetic cut-outs, or circuit breakers, so that should there be an excessive current from any cause or an induction discharge, no serious injury could occur to the apparatus.

Again it is a far simpler and safer matter to re-set a circuit breaker as manufactured to-day than to replace a fuse.

The circuit breaker should be opened every night and re-set every morning, thus insuring its being kept in good working condition.

AUTOMATIC STOPS

It is entirely necessary and often convenient to have the car automatically limited in the length of its travel, that is, at the extreme points of safety at the top and bottom of the shaft, or at intermediate points. The operation of these is to shut off the supply of power and apply the brake or brakes to the machine.

With a hand cable controlling device there may be at least two means of stopping—one by means of a clamp or button so fixed upon the cable as to engage with some given point on the car. Then the movement of the car as it comes against the clamp will bring the operating switch to the "off" position and apply the brake to the machine (Fig. 3). The hand cable being connected so as to pull downward to run up and upward to run down.

If a cylindrical or disk form of switch or any switch which revolves upon an axis is used, the switch may be brought to the "off" position by means of a traveling nut attached to the shell or yoke of the switch with fixed nuts upon an extension of the drum shaft or upon a shaft positively driven therefrom. With lever devices the traveling nut or some similar device is generally alone relied upon to accomplish the automatic stop (Fig. 8). In some cases separate auxiliary switches are placed in the hatchway so that the car will open them at the extremes of its travel, thus shutting off the power and bringing the machine to rest.

With the multiple sheave hydraulic type there are simple lever switches which are tripped by the movable or traveling nut at the extremes of travel and which cause the brakes to be promptly applied.

BRAKES, ELECTRICAL AND MECHANICAL.

The requirements of a brake for an electric elevator are that it be absolutely positive in its action, that it be capable of being applied either suddenly or gradually or in proportion to the load or to the speed, according to the will of the operator, that it be capable of quick and easy adjustment and require a minimum amount of it, and that it be durable and substantial in design.

The most common forms are the strap and the shoe-brake and they are usually applied to a cast-iron or steel wheel having a peripheral velocity under full speed that is less than 3,000 feet per minute. In the opinion of the writer a speed of 2,000 feet per minute should not be exceeded.

Brakes are applied in some cases by a weight or powerful spring acting against a dashpot, the brake being held out of action by an electro-magnet or solenoid (Fig. 17).

A purely mechanical brake may be employed using a weight or spring which is controlled by a cam, acting in connection with the lever or hand cable, so that by slowly bringing the operating device to the "off" position the car may be very easily and gradually stopped; with this arrangement it is also possible to get a very quick stop if desired.

SPACE REQUIRED, NEATNESS, CONNECTIONS.

The space required for the machine proper is about the same for the electrical as for the steam machine, power for power, while the service connections are much more sightly and neat. Compared with the hydraulic elevator in ordinary buildings not over eight stories high, the electric machine would not take up one-quarter of the space, power for power.

A winding drum mechanism of 240,000 foot-pounds capacity would take about $38\frac{1}{2}$ square feet of space

COST OF ATTENDANCE EXPERT AND ORDINARY.

The electric elevator, like any other high duty machine, requires some daily attendance, even though it be slight, but the fact of such an attendance being slight is a fruitful cause of its being neglected entirely in many cases

The occasional attendance of an expert is necessary, but for the most part the services of a faithful man of ordinary intelligence giving a brief period of time daily is all that is needed to keep the machine in first-class condition

The brushes of the motor and the contact clips of the switches and the controlling devices are the parts that need the most careful attention. These parts are generally so well designed, however, as to give a good length of service.

The matters of safety and flexibility of service are those of primary importance in elevator construction, while simplicity and low first cost are secondary.

The requirements of elevator service are daily becoming more and more exacting and the end is yet to be reached in the way of development.

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## Mr. Moore's Lighting System.

At a recent meeting of the American Institute of Electrical Engineers there was a very spirited discussion as to the economy of Moore's lighting system, no data having been given by Mr. Moore himself. Nelson W. Perry, who participated in the discussion, said that Joseph Wetzler had made some tests, and called upon him to produce them and to describe his method of making the tests. Mr. Wetzler explained that he had placed his instruments in the interrupted circuit of the lamps, which neither Prof. Anthony nor Mr. Perry thought would give reliable results. Later Dr. Nichols, Prof. Anthony and Mr. Perry were unofficially appointed a committee to make tests. Professor Anthony has written out the results of these tests in the form of a personal report to Mr. Moore, which is herewith appended:

On Wednesday evening, May 20th, in company with Prof. E. L. Nichols and Nelson W. Perry, I made a test of the power absorbed by the vacuum tube light in your exhibit at the electrical exposition, with results as given below:

A Weston ammeter was placed in the circuit leading to the motor used for driving the generator which furnished the current for the vacuum tubes, and a Weston voltmeter was placed across the motor terminals. These instruments were read at frequent intervals, while one of us in the booth below noted the time of turning on and off the light. Comparing notes, we found that when the tubes were all off, the motor consumed 12.5 and 13 amperes at 110 volts as a constant load. When the tubes were all on, the motor consumed 22 amperes at 108.5 volts. The motor therefore consumed when tubes were not running 1,402 watts, when tubes were all running 2,387 watts; due to tubes, 985 watts.

There were in operation 14 tubes, $7\frac{1}{2}$ feet long, $1\frac{3}{4}$ inches diameter, one tube somewhat shorter, but $2\frac{1}{2}$ inches in diameter, and a few small tubes of special design.

We estimated that the whole was an equivalent of 16 of the $1\frac{3}{4}$ inch tubes. This gives 61.6 watts per tube applied to the motor terminals. Assuming that 80 per cent. of the energy was delivered to the tubes from the generator terminals, the power consumed by each tube is 49.28 watts.

This is practically the result obtained by Mr. Wetzler, by direct measurement of the energy consumed by the tubes, and disposes of the question raised by the writer as to the reliance to be placed upon the indications of a Weston ammeter in circuit with a vibrating interrupter.

The only question now is as to the intensity of the light obtained. Of this it was impossible, under the conditions, to make any reliable estimate. Our results simply show that the light of the vacuum tubes as exhibited in your booth at the exposition, is obtained at the expense of a little more than one horse power.

The instruments used in making these measurements were kindly loaned for the purpose by Mr. Pionnie in charge of the Weston Electrical Instrument company's exhibit, who gave us his assistance in making the necessary connections and in taking readings.

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# CORRESPONDENCE.

## New York Notes.

NEW YORK, May 23.—Accidents in Brooklyn due to the trolley cars are again becoming numerous and causing a great deal of comment from the press of that city; the lack of efficiency in running the cars, since the Nassau company has secured the lines of the various systems in Brooklyn, is also criticised. The cars are in the hands of men unaccustomed to the lines over which they are run, and it is said that orders have been given, when cars are at all late, that no stops be made. There is consequently much complaint. Since President H. M. Littell of the Atlantic Avenue Railroad company has been out of the active management, it has become very apparent that the Nassau company would do well to place this matter again in his hands.

On Wednesday the Brooklyn bridge trustees awarded contracts for their electric railway plant for the structure as follows: Babcock & Wilcox company, 800 horse power in boilers, $4,350. Southwark Foundry & Machine company, two 600 horse power engines, $10,400. Walker Manufacturing company, two generators, $15,840; Pullman's Palace Car company, twenty 48-foot cars, electrically equipped, $3,200 each. When all the contemplated improvements are made, Trustee Henriques says, the trains can be run on one-minute headway, and the present congestion of traffic will be much relieved.

Disinterested students of the transportation problem

in this city will not be greatly surprised to learn that all hope for underground rapid transit in New York city for a long time to come was destroyed by the decision which was handed down yesterday by the Appellate Division of the Supreme Court. The Board of Rapid Transit Commissioners failed to get the consent of property owners in Broadway for the proposed underground railroad, and the General Term of the Supreme Court appointed a special commission to take testimony and report upon the advisability of building the road according to the plans which had been adopted The special commission some time ago reported in favor of building the road. The court of last resort has now decided against the report and consequently against the building of the road as proposed. Two opinions on the subject were handed down. Presiding Justice Van Brunt wrote the opinion, all other justices of the court concurring, in which the report of the special commission is criticized and disagreed with mainly on the ground that questions of the possible cost of the underground railroad were not properly considered. The other opinion, written by Justice Rumsey, all the other justices of the court concurring, declares that the plans did not provide for a complete system of rapid transit, while they would require too vast an expenditure of money, and for those and other reasons the court cannot permit the building of the road without the consent of the property owners.

The Morris County Electric company has purchased a lot, 300 by 123 feet, of the Youngs estate, in Morristown, N. J., which is separated from the present station by the tracks of the Delaware, Lackawanna & Western railroad. The present quarters are cramped, and the company will erect a boiler plant on the new lot, and use the present building for engines and dynamos. Permission has been secured to build a tunnel beneath the tracks large enough to hold pipes and permit men to walk through.

W. F. O.

## PERSONAL.

H. L. Aldrich, the enterprising representative of *Cassier's Magazine* of New York, was in Chicago on Monday.

## TRADE NEWS.

H. F. Woods, purchasing agent of the West End Street Railway company of Boston, is offering for sale several large multipolar 500 kilowatt generators, which are all in good condition and fitted with all necessary auxiliaries. It will be advantageous for those interested in such apparatus to communicate with him.

The Sprague Electric Elevator company of New York has secured the order for placing elevators in the new building of the Massachusetts Benefit Life association, which is being erected on State street in Boston. This building, when completed, it is said, will be the finest office building in New England. The contest among the elevator firms for this order was unusually keen, and, after the closest investigation into the merits of all kinds of elevators, the order was given as stated

The Metropolitan Electric company is highly elated over the success of its great catalogue. It has had orders for it from Her Majesty's government, Turkey in Asia, the gold fields of Johannesburg, Australia, Central and South America, and pretty much around the entire globe, and wherever the catalogue goes it brings the highest encomiums for its comprehensive character and attention to details. Those who are interested in electricity in any way should get a copy, as it is a great help as a "ready reference book" and an "encyclopedia of everything electrical."

It is with a feeling of regret that the WESTERN ELECTRICIAN gives place to the following announcement from the Weston Engine company of Painted Post, N. Y., dated May 16th. "We are sorry to announce that our entire plant, together with a large number of engines nearly ready for shipment, was totally destroyed by fire at four o'clock this morning, our offices and pattern safes, together with a large portion of our patterns and flasks, were saved, leaving our loss probably in the region of $100,000, upon which we have an insurance of $40,000. Unfortunate, not only in this loss of fire because of our consequent inability to fill orders, of which we have enough to have kept us running for months. We have already leased a foundry in Corning, and will have our force of molders on that point, thus carrying on our foundry work with little loss of time We are also making plans to get sufficient machine work done to fill our most pressing engine orders, while our plans for rebuilding on an extended scale are being perfected. We have a number of flattering offers to locate in neighboring cities, and at the same time our townspeople are taking vigorous action in the way of making it an object for us to rebuild here. This disaster, while it will necessitate our rebuilding, will enable us to thoroughly modernize our plant, which heretofore has been entirely inadequate for our needs. Meanwhile we beg the indulgence of our patrons, feeling sure that the courtesy always extended to us will be granted now." The company's energy and enterprise in the face of misfortune are sure to be appreciated.

## BUSINESS.

Metal users will value the recently issued price-list of the Phosphor-Bronze Smelting company of Philadelphia. This company is the original manufacturer in the United States of the "elephant brand" of phosphor-bronze and other alloys. Phosphor-bronze is used for telephone and telegraph wire and for other electrical purposes

The Electric Appliance company has succeeded in producing, with a few slight changes from the regular Upton arc lamp, a lamp that will burn 30 hours with a single pair of carbons. This lamp is meeting with much favor, and will probably largely displace the regular 10, 12 and 15 hour lamps. In addition to its great convenience, the question of its economy is a point which cannot be overlooked.

H. E. Collins & Co. of Pittsburg and Chicago have sold 5,000 horse power of the Cahall vertical water tube boilers to the Carnegie Steel company for the Edgar Thomson Works. This order was secured after testing and experimenting with 2,000 horse power for two years. The firm has also sold 500 horse power of the Cahall horizontal water tube boilers to the Nekoosa Paper company, Nekoosa, Wis.

Fisher & Cramphorn have formed a partnership to manufacture the Lyon brake handle and the well known line of knife switches formerly made by the Consolidated Electric Manufacturing company. They have taken a floor in the building at the corner of Congress and A streets, Boston, and are fitting it up with the latest machinery for the production of these goods and high-grade electrical specialties. Both of the gentlemen named have been long identified with the electrical trade, having been for several years associated with the Consolidated Electric Manufacturing company.

The electrical trade in general, and especially those of the fraternity in Chicago, will be interested to know that P. H. Polglase has been appointed manager of the Chicago office of the Adams-Bagnall Electric company of Cleveland, O. Mr. Polglase is an experienced and popular salesman, having been with the General Electric company and also with the National Electric company's office in Chicago. His well known interest and energy in his work and ability to "get there" will undoubtedly prove of value and result in a rapid growth of business in a territory where his company's interests are already rapidly advancing.

The Armorite Interior Conduit company of Detroit, Mich., operating under the Cummings patents, is meeting with large success in the introduction of its "armorite" conduit. The claim made for this specialty is that it is the best insulated conduit manufactured. It is an iron armored tube, very flexible, so much so that bends can be made cold up to one inch conduit. The interior of this tubing is very smooth, allowing the wires to be pulled through without any difficulty. The company is one of the James F. Cummings specialties. The underground conduit of the Cummings Conduit company, also of Detroit, has now a national reputation. In Chicago this last named company is doing considerable work. Mr. Cummings, the designer of both armorite and the Cummings conduit, is an expert in underground electric light service of long experience. Mr. Cummings has been engaged in this work and has been pushing the Cummings conduit for a number of years. His success is well deserved, and it is fair to predict that armorite will prove itself worthy of its flattering reception by the trade. Both companies have unsurpassed factory facilities in Detroit.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued May 19, 1896.*

560,184. Magnetic Separator. Frank J. Barnard, Seattle, Wash. Application filed September 20, 1895.

A magnet is located over the sluice, with a conveyor plate formed of non-magnetic material located under the magnet and over the sluice, and suitable means are provided in connection with the plate for reciprocating it.

560,193. Block Signal System. Alvah L. Creelman, Chicago, Ill. Application filed December 21, 1894.

A signal is adapted to be operated by the current of a power wire circuit, an electric light is included in the circuit, with shunt circuits around the signal and electric light; a magnetic device is arranged to open one and close the other shunt circuit alternately, and an auxiliary circuit is adapted to control the magnetic device, and includes suitable circuit controllers arranged to be operated by the passing train.

560,195. Sales Indicator and Alarm. Carroll F. Davis, Missoula, Mont. Application filed August 2, 1895.

Means are provided for electrically actuating an indicator and an alarm a fixed number of times.

560,212. Circuit for Latent Signal Transmitters. Felix B. Herzog, New York, N. Y. Application filed February 14, 1885.

One claim is for a normally open circuit signal transmitting mechanism at one station, a device for closing the circuit by the act of preparing the transmitter to transmit its signal, and means on another circuit for controlling the operation of the signal transmitter.

560,216. Electro-magnetic Dash-pot. John D. Ihlder, Yonkers, N. Y. Application filed February 8, 1895.

The combination is claimed with a field magnet and a disk or armature, of a brake piece connected to the field magnet, and means for adjusting the air space between the brake piece and field magnet, the brake piece bearing on the armature and acting as a brake.

560,217. Electric Automatic Stop for Elevators. John D. Ihlder, Yonkers, N. Y. Application filed July 27, 1895.

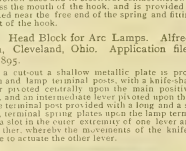
The feature of the invention is the combination with an electric motor and a short-circuit therefor, of a switch controlling the circuit, and an automatic stop-device controlling the switch.

560,255. Hanger for Electric Arc Lamps. Thomas H. Brady, New Britain, Conn. Application filed January 4, 1896.

This apparatus consists of a dependent hook, which is made of electrically conductive material, and is provided with a hollow base of like material in combination with a flag spring, which is made of like material, is seated within the hollow base and in electrical contact therewith, extends across the mouth of the hook, and is provided with a hole located near the free end of the spring and fitting over the upper end of the hook.

560,262. Head Block for Arc Lamps. Alfred N. Edeburn, Cleveland, Ohio. Application filed August 12, 1895.

In a cut-out a shallow metallic plate is provided with main and lamp terminal posts, with a knife-shaped switch lever pivoted centrally upon the main positive terminal post, and an intermediate lever pivoted upon the main negative terminal post provided with a long and a short extension, terminal spring plates upon the lamp terminal posts, and a slot in the outer extremity of one lever and a pin in the other, whereby the movements of the knife lever will serve to actuate the other lever.



NO. 560,184.

560,265. Electric Railway System. John C. Henry, Westfield, N. J. Application filed November 26, 1895.

It is proposed where the car takes current from a pair of insulated conductors located in line with the roadway to have one of the conductors connected to and having its current carrying capacity supplemented by the track rails, with which the traveling contact is not in direct traveling connection.

560,269. Electric Railway. Nicolaus Leidgen, Milwaukee, Wis. Application filed March 11, 1895.

A trolley wire supporting device for electric railways is described, comprising a hanger having curved sides for receiving the ends of the wire sections, the sides terminating in upwardly inclined cam surfaces, and weighted eccentrics pivoted to the hanger for clamping the ends of the wires against the curved sides.

560,271. Registering Dynamometer. George W. Lewin, Fall River, Mass. Application filed December 23, 1895.

In this device there are a vibrating arm, a bar adapted to operate it and mounted at one end upon a resistance coupling eccentrically thereto, a shaft to which the coupling is fastened, a second shaft located with its end abutting the end of the shaft first mentioned, and having a driving coupling fastened thereon, a series of springs mounted upon the couplings respectively, and means adapted to connect the couplings and to vary the eccentricity of the mounting of the bar in proportion to the degree of the compression of the springs.

560,272. Connection for Storage Batteries. Robert McA. Lloyd, New York, N. Y. Application filed November 16, 1895.

The combination with a secondary battery element having a projection, and with a contact containing mercury, of a copper connector secured to the projection and engaging the mercury, and provided with a band of enamel between the projection and mercury contact.

560,275. Switchboard. David M. Munro, Gaithersburg, Md. Application filed February 26, 1896.

In a switchboard, a series of loops connected to the pairs of terminals of the subscribers' circuits, each loop having a series of bridges, each bridge being adapted to a bridge on one of the other loops, and independently operated switches whereby any one, or more, or all of the bridges can be substituted for the bridge adjacent thereto on the single loop, and be brought into a single continuous circuit therewith.

560,284. Electric Igniter for Gas Lighting. William F. Rudolph, Philadelphia, Pa. Application filed September 6, 1895.

The device consists of a fixed electrode projecting over the burner opening, a movable electrode, a bracket supporting the latter, a lever adapted to move in the same direction to axially rotate the movable electrode in the bracket to cause the same to be caught into and out of contact with the fixed electrode, a stop cock, and a link connecting the stop-cock with the lever operating the fixed electrode.

560,291. Electrical Furnace. Edward G. Acheson, Monongahela City, Pa. Application filed June 25, 1894.

The process is described by which material may be treated in an electric furnace for the production of silicide of carbon, comprising a carbonaceous material, a silicious material, a fibrous material and a flux.

560,313. Polar Relay. Thomas B. Dixon, Henderson, Ky. Application filed March 27, 1896.

In this instrument a polarized armature is movably mounted, and main, secondary and tertiary magnets, all arc each arranged when energized to tend to deflect the armature in one direction or the other according to the polarity of the coils, circuit-controlling devices are arranged to re-

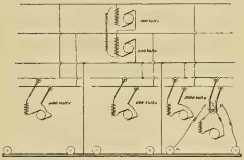
verse the currents in the secondary and tertiary coils successively when the direction of the current in the main coils is reversed, and to give the secondary coils the same polarity as the main coils, and the tertiary coils the opposite polarity.

560,328. Dynamo-electric Machine. Richard Schorch, Darmstadt, Germany. Application filed December 14, 1893.

This is a machine with open-coil armature winding, in which there is the combination of a magnetic field, consisting of two magnet poles or more, each two adjacent ones of which are of opposite polarity, and their pole surfaces each having such a length that the distance between two poles has double the length of a pole surface, with an armature divided into thrice as many bobbin spaces as the magnetic field has magnet poles and of the windings of these bobbin spaces one or more bobbin groups being formed in the manner that the bobbins of each alternate bobbin space are connected at one of their ends with a ring conductor, so that, if a bobbin of such a group is covered entirely by a pole surface the two following bobbins of the same group lie outside the next pole surface, one on each side of it.

560,340. Shunt Circuit Water Rheostat. Jules Buchel, New Orleans, La. Application filed December 7, 1894.

There is provided a receptacle containing the resistance liquid, the main circuit plates immersed therein, and the shunt circuit plates also immersed in the liquid.



NO. 560,265.

560,359. Device for Railway Signaling or Other Purposes. Michael B. Leonard, Richmond, Va. Application filed February 5, 1895.

In the system described the features are the ground switch, its two contact plates, a locking armature lever by which the switch after having been moved from that plate with which it is normally in contact to the other plate is when returning to "normal" automatically arrested and locked in neutral position out of contact with either plate, a spring for drawing the armature into locking position, an unlocking magnet for influencing the armature against the stress of its spring included in an electric circuit, a circuit-closer controlling normally open contacts in the circuit and located adjacent to, but electrically independent of, the track rails, and actuating means attached to the last or other selected car of a train passing over the track, whereby the passage of the selected car and that car only will operate the circuit-closer to close the circuit of the unlocking magnet.

560,360. Electrical Apparatus and System. Michael B. Leonard, Richmond, Va. Application filed February 19, 1895.

The arrangement includes two stations, each equipped with call or signal appliances and electric connections therefor, and signal lever locking appliances, and unlocking relay or magnet, circuit connections therefor, and a battery included in the circuit connections in a shunt to the unlocking magnet at the same station for energizing the unlocking magnet at the other station in such manner that when the circuit is through one battery the unlocking magnet at the same station will be cut out, and vice versa, in combination with a line wire extending between and terminating in a switch at each station, and two contacts controlled by each of said switches, the electric connections in which the call appliances are included terminating at one end in one of said contacts, and the electric connections including the unlocking magnet terminating at one end in the other of said contacts, and one or the other of said circuits being continued through the line wire according to the position of the switch, and being completed only when both switches are on corresponding contacts.

560,366. Method of Attaching Rail Bonds to Rails of Electric Railroads. David W. Payne, Elmira, N. Y. Application filed August 24, 1895.

The method of welding or brazing rail bonds directly to the rails when laid upon a road-bed consists in applying carbon points to the rails on opposite sides thereof at the points selected for bonding, passing a current of electricity from carbon point to carbon point until the rails are heated to or near to the desired temperature, then inserting the ends of the bond between the rails and the proper carbon points, and continuing the application of the current until both bond and rails are brought to the required temperature.

560,370. Electric Igniter for Gas Lighting. William F. Rudolph, Philadelphia, Pa. Application filed November 29, 1895.

The device consists of a fixed electrode in juxtaposition to the burner, a movable electrode having an oscillatory movement and provided with an arm adapted to make and break contact with the fixed electrode, a box connected with the movable electrode, and a stop cock in flexible engagement with said box, and adapted when actuated to oscillate said movable electrode.

560,375. Power Gearing for Electric Cars. Elmer A. Sperry, Cleveland, Ohio. Application filed June 6, 1894.

A power transmitting device extends from the motor to the axle, a yielding coupling forming a part of the device, and an inclosing casing for the device is supported at its center of gravity.

560,379. Electric Measuring Instrument. Elihu Thomson, Swampscott, Mass. Application filed March 29, 1895.

Sets of fixed coils, each composed of a plurality of coils so arranged that the current traverses the respective coils of each set in relatively opposite directions, and passes through similar coils in the several sets in the same direction are arranged with a movable set of coils also composed of a plurality of coils so wound that the current passes in opposite directions in the respective coils. Circuit connections are provided for the different sets of coils.

560,387. Electric Arc Lamp. Ernest J. Bagnall, Cleveland, Ohio. Application filed December 14, 1895.

The cut shows an alternating current arc lamp, with a solenoid and a clutch, and means forming a direct connection without interposed yielding devices between the core of the solenoid and the clutch, whereby the slightest variation in strength of the solenoid will be promptly and accurately transmitted to the carbons, a retarder and a non-limited yielding connection between the retarder and the core of the solenoid to retard the separation of the carbons in forming the normal arc when the lamp is being started.

560,403. Telephone Receiver. Stephen D. Field, Stockbridge, Mass. Application filed August 24, 1895.

A diaphragm of magnetic material, a core of magnetic material presented thereto, and two equal reversely acting windings on the core, one of the windings being nearer the polar extremity of the core than the other, and both being serially connected in the telephone circuit.

560,421. Electric Arc Lamp. James McLaughlin, Chicago, Ill. Application filed May 15, 1893.

A main magnet in series with the arc, a mechanical resistance device inactive when no current is passing through the arc, a pivoted keeper-armature connected with the mechanical resistance device, and adapted at its upper end to move through an extended arc of a circle acted upon by said main magnet to establish and maintain established the influence of the said mechanical resistance device during the passage of the current through the arc, carbon separating devices, intermediate connecting mechanism between said devices, and an auxiliary or supplemental magnet or solenoid adapted to operate to feed or permit the feed of the carbon against the counteracting influence of the mechanical resistance device.

560,423. Coin-controlled Electrical Apparatus. John N. Peirce, Boston, Mass. Application filed February 19, 1896.

The apparatus comprises a casing, electrodes on the exterior of the casing, a battery or other source of electricity, and connections between it and the electrodes, the connections including a movable contact arm adapted to be displaced to break the connection between the electrodes, a time mechanism having a revolving projection arranged to displace said contact arm when at a given point in its revolution, a detent arranged to stop the time mechanism when the contact arm is displaced, and a coin guide or chute arranged to direct a coin against said detent to displace the latter and cause the release of the current-closing arm during a revolution of the projection.

560,427. Circuit Breaker. William B. Potter, Schenectady, N. Y. Application filed January 18, 1896.

A circuit breaker for drawbridges is described, consisting of a horizontal base plate, a contact plate hinged at its forward end, and adapted to yield rearwardly in a vertical plane, the outer face of the contact plate being curved from end to end horizontally, and a spring holding the contact plate in its forward position.

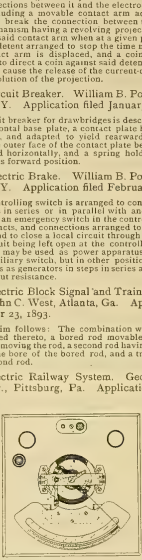
560,428. Electric Brake. William B. Potter, Schenectady, N. Y. Application filed February 3, 1896.

The controlling switch is arranged to connect a plurality of motors in series or in parallel with and without resistance, and an emergency switch in the controller is provided with contacts, and connections arranged to open the trolley circuit, and to close a local circuit through the motors, the local circuit being left open at the controller, by which the controller may be used as power apparatus in one position of the auxiliary switch, but in other positions will combine the motors as generators in steps in series and parallel with and without resistance.

560,451. Electric Block Signal and Train Lighting System. John C. West, Atlanta, Ga. Application filed December 23, 1893.

One claim follows: The combination with a truck, of a sleeve fixed thereto, a bored rod movable in said sleeve, means for moving the rod, a second rod having limited movement in the bore of the bored rod, and a trolley connected to the second rod.

560,452. Electric Railway System. George Westinghouse, Jr., Pittsburg, Pa. Application filed July 27, 1895.



NO. 560,379.

In a circuit closing switch for electric railways, an armature and contact plates, and a loosely mounted support therefor are provided with downwardly projecting pins or lugs, and a spring on which the pins or lugs rest.

560,455. Rail Bond for Electric Railways. Horace W. Wyman and Fred H. Daniels, Worcester, Mass. Application filed June 26, 1895.

The device comprises a rod of circular shape in cross-section, a terminal at each end of the rod made integral therewith, and consisting of a cylindrical portion to extend through the rail, and an enlarged end or head forming a flange or projection to bear on the rail, the cylindrical portion having an opening or hole therethrough of the same diameter for the reception of a drift pin or taper tool.

560,471. Electric Railway Switch and Box Therefor. William Chapman, Washington, D. C. Application filed July 29, 1895.

A contact plate and a supporting base therefor, a clamping ring surrounding the plate, and means for clamping the ring to the base.

560,472. Current Collecting Device for Electric Railways. William Chapman and Percy W. Davies, Washington, D. C. Application filed July 29, 1895.

The last claim is for the combination with a car truck, of supplemental trucks pivotally connected to its ends, a plurality of jointed collecting bars, the end sections of which are supported by the supplemental trucks, and means for connecting the bars together at the joints.

560,473. Electric Railway. William Chapman, Washington, D. C. Application filed August 1, 1895.

A traveling contact bar comprising a plurality of sections insulated from each other, and means for cutting one of the sections into and out of circuit at will.

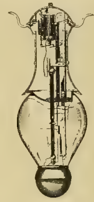
560,476. Electric Arc Lamp. Charles L. Coffin, Detroit, Mich. Application filed March 13, 1894.

The combination with a positive electrode of an electric arc lamp of a magnet having the lines of its field of force substantially parallel with and in the same direction as the current passing through said positive electrode, and having its north pole presented to the arc, the arrangement being such as to reduce the counter-electromotive force of the arc.

560,503. Safety Device for Electric Motors. John D. Ihlder, Yonkers, N. Y. Application filed September 12, 1892.

The combination with an electric motor of a duplex shunt circuit of relatively high resistance, including two parts of a magnet coil and a safety device arranged in the duplex shunt circuit.

560,513. Electric Railway. Robert Lundell, Brooklyn, N. Y. Application filed December 6, 1895.



NO. 560,387.

This is a system of permanent or continuous inter-connections between electro-magnetic switches and sectional trolley conductors, the arrangement being such that each electro magnetic switch is given a certain time allowance to close before it is called upon to transmit the propelling current, no matter which way the car or train be moving.

560,533. Manufacture of Metallic Articles by Electrolysis. Marcel Perreur-Lloyd, Paris, France. Application filed September 26, 1895.

The method of effecting the electrode deposition of metal on a cathode in a smooth, regular and finished manner consists in applying to the slight roughness or asperities on the surface of the cathode a very thin coating of fatty matter, whereby the deposition on the surfaces so coated is more or less retarded or prevented, and the molecules of the metal deposited are allowed to fill up the adjacent depressions, and simultaneously passing the electric current through the electrolyte.

560,551. Electric Railway System. Daniel MacL. Therrell, Charleston, S. C. Application filed January 9, 1896.

One claim is for the combination of a car, a permanently magnetized shoe suspended therefrom, a helix attached to the shoe, and a ball-bearing device upon the shoe carrying balls of non-magnetic material of good electrical conductivity.

560,569. Electric Motor Fan. James D. Brinser, Lancaster, Pa. Application filed July 12, 1894.

In a field magnet to be placed within the ring of the revolving armature of a motor for an electric fan the wrought-iron base comprises two oppositely disposed pole-pieces and two perpendicularly placed coil cores between the pole-pieces; a pole-piece and a coil core integrally joined at one end, forged in one piece, each core having its diametrically reduced forward end closely fitted into the orifices in the orifice in the free end of the opposite pole-piece, the cores adapted to have spools with wire coils sleeved thereon, and means provided to hold the pole pieces in position.

560,588. Electric Rheostat or Heater. Harry W. Leonard, East Orange, N. J. Application filed March 20, 1896.

A ribbon-like conductor is attached to a large mass of material, having a high specific capacity for heat, and insulated therefrom by a minimum thickness of insulating material.

560,591. Alternating Electric Motor. Robert Lundell, Brooklyn, N. Y. Application filed February 18, 1895.

An alternating or pulsating current electric motor, having an armature or rotary part provided with two sets of windings, one set being short-circuited or closed upon itself, and the other connected through a commutator or current-collecting device to the secondary of a converter, the primary of which is connected directly to the current mains, the field magnet coils being also connected directly to the current mains.

560,617. Telephone Signal and Signaling Circuit. Achilles de Khotinsky, Boston, Mass. Application filed March 13, 1896.

Claim one follows: The combination of a main telephone circuit extending between a central station and a sub-station, the telephone switch or circuit changer at the sub-station, and switch connections and an associated disconnecting signal at the central station, with a Wheatstone balance or bridge system, the said disconnecting signal being in the bridge or cross wire, and the telephone sub station circuit and circuit changer being connected in one of the resistance arms of the said balance or system.

560,619. Electric Signaling Apparatus and System. Michael B. Leonard, Richmond, Va. Application filed November 10, 1894.

This invention comprises the combination with the ground switch, its detent arm and the locking armature therefor, of the locking magnet for influencing said armature, and an electric circuit including said magnet and completed through two sets of contacts, the one normally closed and controlled by a track treadle or train operated device, the other normally open and controlled by the ground switch.

# Western Electrician.

EVERY SATURDAY.

Vol. XVIII. CHICAGO, JUNE 6, 1896. No. 23


## Electric Elevators in an Elevated Railway Station.

Not because of any particular novelty in design or construction, but, rather, owing to a location that may indicate a new sphere of usefulness, the electric elevator installation which is briefly described in this article will be found of interest to electrical men. It is placed in the western terminal station of the Lake Street Elevated Railroad company of Chicago, on Lake street, near West Fifty-second street, 6½ miles west of State street. As the western terminus of the road, adjacent to several populous suburbs, this is one of the most important station on the railroad structure. The Lake Street company, as has been announced in this journal, is about to discard its steam locomotives and substitute electrically operated cars supplied with current from the power stations of the North and West Side surface roads belonging to Mr. Yerkes' companies. This current is already on the elevated structure and is utilized to operate the elevators which are of such great convenience to the passengers taking the cars at Fifty-second street, obviating a climb of about 23 feet. The electricity for this section of the road, and consequently for the elevators, is supplied from the generating plant

FIG. 1. ELECTRIC ELEVATORS IN AN ELEVATED RAILWAY STATION. STRUCTURE AND ELEVATOR ENTRANCE AT WEST FIFTY-SECOND STREET, CHICAGO.

tions on the line, and, as will be seen by reference to the illustration on this page, it is constructed on a plan differing widely from that of the typical elevated railroad station. The station is a three-story brick building of considerable size, entirely detached from the track structure, which it faces, with the exception of the enclosed passageway or bridge, which is shown in the picture. Entrance is gained from the street through a wide hall between two stores. This hall leads back to the stairs and elevators in the rear of the building, and access to the upper floors is thus obtained. The second story is divided into offices for rent, but the topmost floor, which is about on a level with the top of the railway structure, here of unusual height, is entirely given over to the waiting rooms, ticket offices and other apartments of the railroad company.

Two electric elevators are provided to carry passengers from the ground floor to the level of the waiting

of the Cicero & Proviso Street Railway company at Oak Park, and has, of course, a potential of 500 volts.

As shown by the corner picture in Fig. 1, the elevators are placed side by side, running between walls of masonry. The view shows the landing on the third floor. Each elevator can carry 20 people comfortably. One or both of the machines is running from 6 A. M. to 8 P. M., and the result is very satisfactory, both to the traveling public and the railway management. From six to nine in the morning and from five to eight in the evening both elevators are operated to accommodate the rush of passengers, but at other times only one car is in use.

The mechanism was installed by the Crane Elevator company of Chicago, and an excellent view of one set of electrical machinery and connections, showing the motor, switches, resistance coils and lamps, dash-pot and other regulating apparatus, driving shaft, brake, winding drum, etc., is given in Fig. 2. The motor is of about 20 horse power capacity, and is of a type especially built for elevator work by the Crane company. The starting and controlling devices are automatic in character and do not differ materially from those usually employed in electric elevators of the drum-winding type. They are efficient and give the car smooth, easy motion and quick starting and stopping. The elevators have a specified capacity of lifting 5,000 pounds 120 feet a minute, and are of unusually large size for passenger service.

While the electric elevator service at Fifty-second street is highly appreciated by the patrons of the road at the western terminus, there is no likelihood that it will be extended to the other stations along the line. The conditions are different, and the company would undoubtedly consider the expense prohibitory. But there can be no question that stations equipped with elevators are a great attraction to an elevated railroad, and roads of this character operated by electric power are best fitted to make this very desirable improvement.

## The National School of Electricity Closed by the Sheriff.

[From the *Chicago Tribune* of May 30th.]

Judgments by confession were entered yesterday in the Circuit Court against the National School of Electricity for $5,626 and $469, the first amount in favor of John J. Swenie and the other in favor of Louise C. Stanton. The offices of the concern at No. 335 Dearborn street were closed by Deputy Sheriff McMahon on executions issued upon the judgments.

## Electrical Interests Affected by the St. Louis Tornado.

No reader of the WESTERN ELECTRICIAN can have failed to have heard something of the horrors of the great storm of May 27th, which made a path of desolation through the substantially built city of St. Louis and almost obliterated the suburb of East St. Louis, causing the loss of about 400 lives and perhaps $20,000,000 worth of property. In common with other industries the electric lighting and railway plants suffered severely. One correspondent writes:

The town itself was at once cast into total darkness. The electric plants which supply light for the greater part of the city were rendered useless, and the gas works were either destroyed or what is left was totally unable to fill the need. St. Louis was overcast; no moon could pierce the clouds with its light; and here in a city of half a million inhabitants the citizens went through the streets guided by the rays from the lanterns which they carried, or used candles, as they groped among the ruins of their homes for the forms of their dead. In the houses their candles with an occasional lamp gave the only light, and, to add to the discomfort of the people, as well as threaten grave danger in the case of fire, the water works were practically disabled, so that the supply of water was badly diminished. The scene along Broadway, south of Rutger street, was a remarkable one, when first seen this morning. It was originally what is known as the State road, and is a thoroughfare along which the telegraph companies have strung their wires. Underground wires are as yet unknown in St. Louis, and along this street great poles nearly a foot in diameter upheld cables and single wires which gave this city electrical communication with the rest of the world. These tremendous poles to-day lie prostrate on the street. The wires which they bore lie on the pavement one tangled snarl like a skein of silk after a cat has finished playing with it. Piled on top are mounds of brick blown from the cornice, mingled with the mass of broken timbers, joists of houses, pieces of flooring, the rafters of roofs, and scattered above it all are great masses of tin roofing used in this city abundantly, and which the wind had curled into fantastic forms.

The power house plant of the Union Depot Railway company was badly wrecked, entailing heavy damage, and several persons were killed or injured in the ruins.

In East St. Louis, on the day after the storm, the streets were laced with the fallen wires and blocked by the windrows of poles. Trolley cars, some of them crushed beneath outfalling walls, remained where they were when the untamed air mastered the harnessed electricity. The quick-witted men at the power house shut off the current the instant the storm entered the city, so that all wires were dead and harmless. The condition of affairs was much the same in St. Louis immediately after the storm, but traffic was more quickly resumed.

One of the serious inconveniences of the storm was the temporary loss to the city of the telephone service. The wires were down with the others, and not an instrument in the main part of the city was in use. St. Louis had to go back to the old methods of communication employed before the telephone was invented, and people having business to do realized the great value of this invention in the affairs of modern life.

J. E. Bush of the Chicago Varnish company, who lives in Racine, was in an electric car at Ninth and Olive streets when the cyclone struck that locality. He said:

The car was one of the heaviest built, and two of them stopped together. I think that saved us, for otherwise they must have been blown off the tracks and wrecked. When the storm struck us, two women in the car grew hysterical and tried to get out. I jumped up and held the door closed, for I knew that if the wind got inside all would be over with us. Telegraph and telephone poles were snapping all around us, and chimneys and trees were falling, but we seemed to be lucky and escaped. People were blown off their feet on the sidewalks and carrried down the street. A finely dressed man passed us, driving a splendid pacer. Twenty feet ahead of the car the horse dropped dead to the pavement. It had stepped on a live wire and had been killed instantly.

The Wagner Electric Manufacturing company sends the following reassuring telegram to the WESTERN ELECTRICIAN: "Entirely escaped effects of cyclone. No delay at factory. Orders filled as contracted. Kindly give this prominence." The Columbia Incandescent Lamp company of 1910-1914 Olive street was also fortunate. Several large panes of plate glass were blown out of the office windows, but the factory was practically uninjured. Many of the employes of the company suffered severely from the ravages of the storm, however, and prompt financial assistance was extended by the company.

The citizens of St. Louis are manfully at work on the great task of clearing away the wreckage and rebuilding the blown-down portion of the town. They are self-reliant and think that outside help will not be needed. In the smaller municipality of East St. Louis, however, outside assistance is imperative and is gratefully received.

## Boys' Mischief Causes a Lineman's Death.

It is important that boys and other mischief-makers should be taught that very serious consequences may result from the tampering with wires carrying currents of electricity. There is no means of telling the current traveling over a wire by its appearance in the air or in a conduit, and it is a very dangerous pastime for boys to "have fun" by cutting away the insulation or attaching dead wires to the conductor. It is a pity that innocent persons should suffer from thoughtless mischief of this sort, but they occasionally do; and a human life was sacrificed in Chicago last week as the direct result of meddling with electric wires by a party of boys. A daily paper of May 27th tells the story:

While trying to ascertain the cause of trouble with the underground electric wires at Augusta street and Milwaukee avenue, Samuel Brobson, an employe of the Chicago Edison company, touched a loose wire through which the current passed and was instantly killed.

Early in the evening the wires were tested and it was discovered that the electricity was escaping in some place. Brobson, with two other men, was sent out to find out the cause. He went under the sidewalk at Augusta street and Milwaukee avenue, where boys during the day had attached an uninsulated wire to the wire conducting the current, attaching the loose wire to a pole. While trying to cut the wire, which was the cause of the escaping of the electricity, Brobson received a shock which hurled him several feet, causing death.

The company uses alternating current along Milwaukee avenue, and it is probable that the unfortunate lineman received the fatal shock from the primary circuit through the boys' wire or in some manner while trying to detach it.

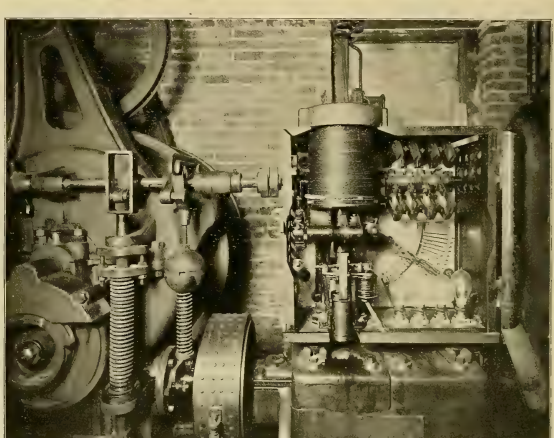


FIG. 2. ELECTRIC ELEVATORS IN AN ELEVATED RAILWAY STATION.—MOTOR MECHANISM.

## There Are Others.

[From the Peoria, Ill., *Journal.*]

The underwriters' movement has brought the public confession from Electrician Norton, who has posed through a quarter of a century of office holding as the only expert in town, that he does not really understand his business. It was the easiest way for him to get out of the corner into which he is driven. The revelations in the Niagara Block show that the inefficiency is of a character so positively dangerous to life and property that it is a wonder the city has not witnessed a series of conflagrations as a result. At the time that the Niagara block was wired O. H. Norton was city electrician, and he was also furnishing electric supplies. As a business man he sold his wares to himself as city electrician, and as city electrician he audited the accounts and secured pay for the service over and above his salary. Miles of wire were sold to the city, and bills plainly and boldly showing this open, insolent defiance of law, were passed by successive city councils.

## Unveiling the Franklin Statue at Lincoln Park, Chicago.

Final arrangements for the unveiling of the Franklin statue presented by Joseph Medill, editor of the *Chicago Tribune*, to be placed in Lincoln Park, were completed at a meeting of the committee in charge of the ceremonies on Sunday, May 31st. It was decided to hold the ceremonies at 4 o'clock Saturday afternoon, June 6th. The statue is by H. R. Parks. It is a bronze figure on a block of granite and has been pronounced a very artistic work. The site selected for the statue is near the Lake Shore drive, almost exactly half way between the north and south limits of the park, and close to the high bridge which spans the lagoon between the outer and inner drives. It faces the northeast. In front of it the road from the center of the park enters the driveway; to its right and some hundred yards away is the animal house, and directly behind it is the Ryerson Memorial. Its location is almost opposite the Garfield avenue and Center street entrances, though separated from them by the entire width of the park, and from either of them it is easily reached. Past the southern of these entrances, the Center street one, run all the cars leading to the park, except those on North avenue, which stop at the southwest corner. They are the limits lines on Clark and Wells streets and the Lincoln avenue lines on Clark and Wells, with the Fullerton avenue trailers. The position is a central one, and as easily reached as any to be found. Between Fullerton avenue and Eugenie street there is no other means of reaching Lake Shore drive than the roadway directly in front of the monument, and a large share of the carriages pass the place more than once in a trip over the park driveways. The statue was placed in position some days ago, and is in readiness for the ceremony of unveiling.

The programme announced by the committee is as follows:

Music by band, commencing at 3:30 o'clock.
Exercises commence at 4 o'clock sharp. M. J. Carroll, chairman.
Presentation address—Joseph Medill.
Unveiling of statue—Rene Bache, a lineal descendant of Franklin, assisted by H. R. Parks, sculptor of the statue.
Music and singing—Band and quartette.
Acceptance of statue—Conrad Kahler, president Old-Time Printers' association.
Music—Band.
Acceptance of statue—Board of Park Commissioners.
Music—Band and quartette.
Oration—H. D. Estabrook.
Ode—John J. Flinn.
Music—Band.
Address—P. F. Pettibone of the employing printers.
Music, "America"—Band, quartette and audience.
Adjournment—Band playing "The Star Spangled Banner."

## The Reconstruction of the Plant of the Chicago Board of Trade.[1]

By Bion J. Arnold.

When the writer agreed some four weeks ago to prepare a paper on the reconstruction of the plant in question, he hoped to be able to present to the Institute today some records of its operation, or data which would be of value, but owing to the delay in the arrival of certain parts of the plant, the question of operating it a sufficient length of time to secure such data proved impracticable, and not wishing to appear before this body with any data the completion of which did not extend over a sufficient length of time to make it reliable he must confine himself today practically to a description of the plant, with the expectation of presenting to this Institute at a later date the records of its operation, in a form which he hopes will be of some permanent value. The plant involves a number of departures from the standard lines of office building engineering, and if the results of

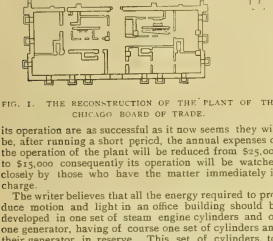


FIG. 1. THE RECONSTRUCTION OF THE PLANT OF THE CHICAGO BOARD OF TRADE.

its operation are as successful as it now seems they will be, after running a short period, the annual expenses of the operation of the plant will be reduced from $25,000 to $15,000 consequently its operation will be watched closely by those who have the matter immediately in charge.

The writer believes that all the energy required to produce motion and light in an office building should be developed in one set of steam engine cylinders and on one generator, having of course one set of cylinders and their generator in reserve. This set of cylinders, together with the working parts of the engine and its generator connected directly to it, constitute the unit which produces the energy of the plant, and this unit should be made to work at its maximum economical load throughout its entire period of operation, while the energy from the unit should all be utilized during its running time. Having this idea constantly in view, the designer of this plant has planned to follow it out as closely as possible.

The old plant consisted originally of six horizontal tubular boilers operating at a steam pressure of about 75 to 80 pounds and driving five small steam engines distributed in different parts of the building, together with the necessary steam pumps, air compressors, etc., used for feeding the boilers, and operating the hydraulic elevators. Two of these engines were belted to a line shaft and drove several small incandescent and arc dynamos for lighting the building. The three other engines were used for driving the ventilating fans, three of which were located in the attic and two in the basement, and were driven by the engine by means of rope-drives with sheaves and ropes running at various angles throughout the building. The elevators were driven by two horizontal compound direct-acting pumps, which consumed from 80 to 100 pounds of water per horse power of energy delivered to the elevator cars. It became apparent after an examination of the plant that if the steam pressure could be increased to 125 pounds per square inch, so as to get the advantage of later steam, and all the pumps in the plant which were consuming steam full stroke eliminated, and the energy of the plant produced by a compound condensing engine running at an economical load, that a large reduction in the operating expenses of the plant could be effected. The old boilers having been in use for about nine years, were almost ready to be condemned by the boiler inspectors; consequently it was an easy matter to decide upon replacing the boilers with heavier ones which would work at the above pressure. The adoption of a compound condensing engine to work under this increased steam pressure was a natural sequence which enabled the energy to be produced with the least possible coal consumption. After quite an extended investigation it was decided to supplant the hydraulic elevators with horizontal screw multiple sheave elevators, as the investigation showed that these machines could be operated for considerable less money per car mile than the hydraulic elevators, under the conditions which existed in this plant. The operation of these elevators in practice has fully proven the correctness of this position. They have been in operation about four months now, on an average consumption of 4¾ kilowatt hours per car mile, and as the duty required of them is exceptionally heavy, and the cars very large, this showing is very satisfactory.

The general plan of the plant is as follows:

Referring to Fig. 1, which represents the basement of the Chicago Board of Trade, the relative location of the different machines which enter into the plant can be determined. It will be seen that the installation consists of the following: Five 5½ by 16 feet horizontal tubular boilers designed to carry 125 pounds pressure per square inch; two 150 horse power horizontal compound condensing engines running at 275 revolutions per minute, each directly connected to a 75 kilowatt direct current generator, under a special system hereinafter described, which permits of either or both generators being driven from either engine, four horizontal 90 horse power multiple sheave elevators, six 10 horse power electric motors, five of which operate ventilating fans, and one the machinery in the machine shop, 50 2,000 candle power constant potential arc lamps and 600 16 candle power incandescent or glow lamps. There are also 65 1,000 ampere-hour storage cells, and the necessary switchboard and connections for the handling of the above machinery, all of which is more distinctly described hereafter. One of the compound steam pumps has been retained in order to keep the tank on the roof of the building supplied with water for use in the wash-basins, closets, etc. It may prove advantageous in the future to substitute for this an electrically driven pump, but it has been thought best not to discard the old one at present, inasmuch as it is already on hand.

Fig. 2 represents diagrammatically the main leads or copper conductors of the building, used for the operation of the above described electrical machinery. The general plan is clearly shown by the diagram, and this system was adopted owing to the fact that the building was so constructed that two main flues or passageways extending from the basement to the attic, in opposite portions of the building, and near its centers, were available for carrying the main risers. It was decided to place in these passageways vertical risers of sufficient carrying capacity to carry the total amount of energy required for the fifth floors, and to join the floor leads or secondary mains to each of these risers at their ends. With this arrangement it was possible to feed the secondary mains at two independent points, thus equalizing the pressure to better advantage and making the plant more reliable in operation. From the center of these vertical risers, or at about the fifth floor, the main leads drop down each shaft, thence extend horizontally on the ceiling of the basement to the switchboard. Each of the mains leading to the center of distribution in each shaft is of sufficient carrying capacity to carry the total load of the building, exclusive of the basement; consequently if a fuse blows on either one of the mains or if by any accident one of the mains should become broken or opened, the other main will carry the necessary current and keep the lights operating in the building. This precaution was taken owing to the fact that business matters of great importance are transacted in this building, and the loss of a few minutes in certain times would be disastrous to the men who operate in the building; consequently every precaution for safety and reliability had to be taken.

The basement circuit is independent of the above described mains, and consists of positive and negative leads, surrounding the entire basement of the building, from which are tapped the arc and incandescent lights used in the basement. The motor circuits are closely indicated in the diagram, and are independent of the lighting circuits, and are so planned that the starting rheostats of the motors are connected on the switchboard under the control of the engineer, thus making it possible for the engineer to start or stop any motor in the building without leaving the switchboard. The elevator circuits are also independent of the lighting and motor circuits, and it is possible to throw the current on

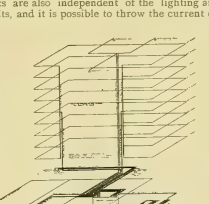


FIG. 2. THE RECONSTRUCTION OF THE PLANT OF THE CHICAGO BOARD OF TRADE.

or off any elevator at the switchboard. The batteries are located in a room adjoining the main engine room, and connected with the switchboard, as shown on the diagram.

The losses in the wiring circuits of the building are computed as follows: Between generator and switchboard, one-half of one per cent.; between switchboard and center of distribution, two and a half per cent.; from center of distribution to secondary mains, one per cent.; between secondary mains and lights, one per cent.—making the total loss between generator terminals and lights five per cent.

Fig. 3 represents (largely diagrammatically) the switchboard of the plant. From this it will be noticed that the plant is designed for three generators, but two of which are now in operation, as they are sufficient for the work. The lighting bus-bars carry the main lighting circuits, controlled by switches 7, 8 and 9, and also the motor circuits controlled by switches 1, 2, 3, 4, 5 and 6. In the main lighting bus-bar is placed a recording wattmeter, which registers all the energy delivered from the generator to the light and motor portions of the plant. In the elevator bus-bars is placed another recording wattmeter, which registers all the energy delivered to the elevators from the lighting bus-bars. With this arrangement and the means available in the plant for measuring the amount of coal and water consumed, the operators are enabled to keep accurate daily records of the cost per kilowatt of the energy produced and delivered by the plant. The diagram of the switchboard clearly shows the windings of the different generators and motors, and need not be further explained.

The generators are connected to the board by means of two switches, one of which is a triple-pole double-throw switch, and is arranged so that when thrown into the upper position it connects the generator to the elevator bus-bar, using the compound winding of the generators. This arrangement permits the generator to

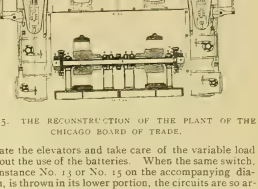


FIG. 3. THE RECONSTRUCTION OF THE PLANT OF THE CHICAGO BOARD OF TRADE.

operate the elevators and take care of the variable load without the use of the batteries. When the same switch, for instance No. 13 or No. 15 on the accompanying diagram, is thrown in its lower portion, the circuits are so arranged that the compound or series winding of the generator is cut out, and the equalizer connection from the generator becomes the positive connection, and the generator is connected to the elevator bus-bars shunt wound, thus eliminating its series winding. With this arrangement, the generators and the batteries are run in multiple on the elevator load.

Referring now to the right-hand part of the board, which is the storage battery portion proper, the operation is as follows: Under normal conditions, any elevator is operated shunt wound in parallel with the batteries by closing its corresponding switch, as, for instance, switch 15 for dynamo No. 3, downward the 15 *b* position. By closing switch 17 to 17 *a* position, the current passes from the positive elevator bus-bar to the hand regulating cell switch, and out to cell No. 16, when the regulator is placed as shown on the diagram. From cell 16 the current passes through the series of cells coming out at the negative end, thence through the proper conductor to the recording ammeter, thence to the overload switch and finally to the negative terminal of switch No. 17 *a*. It will now be seen that whatever number of batteries are being operated in this series are in parallel with the generator. The hand regulator is placed in the position indicated to enable the operator to cut in a sufficient number of cells in parallel with the generator, so that the cells will be constantly charging during the time of operation of the elevators except at the temporary moments of overload caused by an excessive demand for energy by the elevators. When this pull from the elevator occurs, the batteries respond and take the surplus load from the generator. With this arrangement, about 50 of the cells will be kept constantly charged, and in parallel with the elevators. In case the amount of current entering the cells is excessive between the intervals of heavy load on the elevators, the hand regulator is adjusted so as to cut in one or more cells until the current becomes reduced to the proper amount for the load, and on the other hand, if the amount entering the cells is not enough to keep them properly charged, the hand regulator is adjusted so as to cut out a number of cells until the proper amount of current is reached. In the meantime, if the 15 end cells require charging, they are charged by means of the independent booster or motor-generator in the manner hereinafter described. All the batteries can be operated in parallel with the generators when running shunt wound in the same manner as they are used in conjunction with the elevator bus-bars, by closing switch 17 downward to position 17 *b*. The connections for same can be easily followed on the diagram.

In order to operate the batteries in parallel with both the lighting and the elevator bus-bars at the same time and maintain a practically constant voltage on the lighting bus-bars, it is necessary to operate the generators shunt-wound instead of compound-wound. As before shown, the switches are so arranged that the compound winding of the generators can be utilized when the batteries are not in service, and the shunt winding used when the batteries are being run in parallel with the elevators and lights. Therefore, to maintain a practically constant voltage on the lighting bus-bars and to run the elevators in parallel with the batteries at the same time, the operation is as follows: Switch 17 *a* is closed up-

1. Read at the general meeting of the American Institute of Electrical Engineers, New York, May 20, 1896.

ward and operates as previously described in conjunction with the elevators and batteries. Switches 10, 12 and 14 are open to prevent the generators operating compound-wound on the lighting bus-bars. Switch 16 is closed and the current passes as follows: From the positive elevator bus-bar through the switch 17 *a* to the center of the hand-regulating-switch, thence through the connection from the hand regulating switch to the corresponding cell (shown on the drawing as cell 16), thence through the series of 49 cells, out through the negative end and its corresponding connection, through the recording ammeter and overload switch, to the negative side of switch 17 *a*, thence to the negative elevator bus-bar. It should be borne in mind that the lighting bus-bars and the elevator bus-bars are operating at different potentials, and that the potential on the elevator bus-bars is changing slightly with the change of load, caused by variable load on the elevators. When the demand for current from the cells is great, as for instance when the elevator load is severe, the electromotive force of the number of cells in parallel with the elevators necessarily drops, consequently the electromotive force of the number of cells in parallel with the lighting bars, which includes all the cells working with the elevators, and a few of the regulating cells, would correspondingly drop, and some means must be provided to hold up the voltage of the lighting bus-bars. This is accomplished by means of the automatic regulator which is controlled by a solenoid switch, shown in the upper right-hand portion of the diagram. This solenoid switch operates by means of suitable connections to the lighting bus-bars, in such a manner as to make and break the circuit through mercury cups, as follows: When the voltage of the lighting bus-bars is reduced slightly, one side of the field of a right and left hand motor is thrown in, which causes the arm of the automatic regulator to move clock-wise, thus cutting in more cells in parallel with the lighting bus-bars and holding the electromotive force up. When the electromotive force of the lighting bus-bars reaches its proper voltage and tends to exceed it, the solenoid acts in the opposite direction and cuts in the left-hand field of the automatic regulator motor, and brings the left-hand field into service, causing the automatic regulator to rotate contra-clock-wise, thus cutting out cells until the voltage reaches the desired point. By this means a constant electromotive force is maintained on the lighting bus-bars, and the cells are worked in parallel with both the lighting and elevator bus-bars.

It will be evident that the 15 end cells, or at any rate a portion of them, when working in this manner, will become discharged through the day's run. After the batteries are cut off from the lights these end cells are recharged as follows: Switch No. 23 is closed, thus throwing in the booster motor. As soon as the booster dynamo is brought up to speed, the underload switch is closed, and switch No. 22 closed upward, the operation then being as follows: From the positive brush of the generator end of the booster, which is producing energy

FIG. 4. THE RECONSTRUCTION OF THE PLANT OF THE CHICAGO BOARD OF TRADE.

at a low voltage, the current passes through the proper conductor to the center of the automatic regulator; thence out through the regulator arm to segment No. 1, and through its proper connection to cell No. 1; thence throught the first 15 cells to the wire leading off between the fifteenth and sixteenth cell. From this point it passes along the conductor, through switch No. 24 to the underload switch, and from the underload switch back to the negative side of the booster generator. By means of a field rheostat, located on the switchboard, the electromotive force of the booster generator is regulated and adjusted to correspond to the number of end cells which are being charged.

To charge all the cells in series from one of the main generators, it is necessary to increase the electromotive force a sufficient amount to overcome the total voltage of the cells. This is done by placing the generator portion of the booster or motor-generator in series with the main generator as follows: Switch No. 23 is closed, thus throwing in the booster motor and at the same time energizing the fields of the booster dynamo. The booster motor is now started by means of its rheostat and brought up to speed. Switch No. 22 is closed downward, the path of the current then being as follows: From positive lighting bus-bar through switch 22, to the underload switch, thence to the negative brush of the booster dynamo, out through the positive brush to center of the automatic regulator, through this arm to segment No. 1, and thence through suitable connection to cell No. 1; through the entire series of cells to the negative lead, thence through the recording ammeter and overload switch, back through switch 22 to the negative lighting bus-bar. The operations for manipulating the entire plant being then as follows:

To charge all the cells in series with the main generator by means of the booster: Open switches 16 and 17 and close switches 23 and 22 down.

To charge all the batteries, except the end cells, at the same time operate light and elevators from one dynamo: Place hand regulator on segment 16, connect whatever dynamo is in use to elevator bus-bar by means of its elevator switch, either 11, 13 or 15, in the *b* position. Disconnect dynamo from lighting bus-bars by opening its corresponding switch, either 10, 12 or 14, and see that switches 22 and 23 are open, and that switches 16 and 17 are closed, the latter in the *a* position.

To charge end cells with booster dynamo: Place automatic regulator on segment No. 1, see that switch No. 16 is open, and close switches 23 and 22 up.

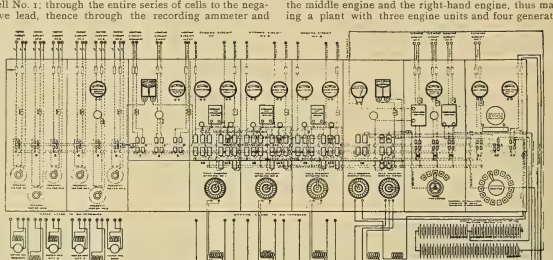


FIG. 3. THE RECONSTRUCTION OF THE PLANT OF THE CHICAGO BOARD OF TRADE.

To place elevators, batteries and one of the generators in parallel, close the corresponding generator switch to the *b* position, and close switch 17 to the *a* position, if desired to run through the hand regulator, and to the *b* position if desired to operate through the automatic, but if placed in the *b* position, see that switch 16 is open.

To discharge the batteries with the generators shut down, operate as follows: On lights, open switches No. 22 and 24, and close switch 10. On elevators, close switch 17 to the *a* position. To operate lights and elevators, see that switches No. 22 and 24 are open, and close switches 16 and 17, the latter to the *b* position

Fig. 4 shows the elevation of this switchboard, and from it the position of the instruments shown on the diagram can be easily located.

The method of connecting the engines and generators is shown in Fig. 5, and represents a system planned by the writer, which enables a direct-coupled plant to be so built as to have the advantage of an independent unit direct-coupled plant when operating under normal conditions, and all the flexibility of a belted plant in case of accident to any particular part of the plant. The cut shows the plan, elevation and section. It will be noticed that at present there are but two generators and two engines; but when extensions are needed the right-hand engine will be disconnected from its present dynamo and moved to the right a sufficient distance to allow the placing of an engine of double its capacity in the same position it now occupies, and two generators between the middle engine and the right-hand engine, thus making a plant with three engine units and four generator units, all four of which are available from the middle engine, and two of which are available from each of the outside engines. Referring to the sectional view, *A a* represent the ends of the engine shafts which carry disks *H h*. The generators are mounted upon hollow sleeves or quills, which are supported in independent bearings *P P* and *p p*. The ends of these quills are enlarged to form flanges corresponding in diameter and thickness to the engine flanges. Between the engine shafts *A a* extends an auxiliary shaft *E* (coupled at its center, in this case, to permit half of the plant being put in operation before the other half is ready), and carried in independent bearings *D d*. The shaft *E* carries on each end circular disks, which in this case are forged solid with the shaft. Under normal conditions shaft *E* does not revolve, but lies passive in bearings *D d*, and the engines drive the generators direct-coupled, by inserting the bolts *U u*, three of which, spaced 120° apart, are used in each coupling. It is now evident that each engine is operating an independent direct-coupled generator without revolving any more shafting or machinery than is usual in ordinary independent unit direct-coupled plants, inasmuch as the quills which surround the auxiliary shaft *E* do not come in contact with it, but have a clearance of one-quarter of an inch all around it. If from any cause it becomes desirable to drive the left-hand generator from the right-hand engine, it is done as follows: In the openings *v*, three of which are provided 120° apart, are placed taper bolts which couple the auxiliary shaft *E* solidly on the engine shaft *a* by means of disk *h*. Taper bolts are also placed in spaces *W*, which couples shaft *E* to the quill of the left-hand generator. By removing bolts *U*, which disconnect the left-hand generator from the left-hand engine, the left-hand generator can now be driven from the right-hand engine, and the right-hand generator continues in operation from the same engine, if desired. By removing *u*, the right-hand generator becomes disconnected from the right-hand engine, and the left-hand generator is being driven from the right-hand engine. In the same manner the right-hand generator can be driven from the left-hand engine, or both generators from either one of the engines. By using compound engines, so designed that by working high pressure steam in the low pressure cylinder, one engine can be made to double its power for a few hours. The plant has thus the total generator capacity available at all times and allows one engine to be in reserve for repairs, thus doing away with the investment of the third unit, which is usually carried in such plants for safety. The system, when used without the battery auxiliary, instead of being provided with bolted connections as here shown, is provided with magnetic clutches, which permit the generators to be brought up to speed as motors, and thrown in connection with the engines without stopping either engine in use. This makes it possible to connect either generator with either engine without shutting down the plant in any part. With such an arrangement, with the engine and generators equal to the maximum capacity of the plant, and battery auxiliary equal to one-third the capacity of the plant, any office building can be operated in the most economical manner, according to the writer's belief, for when the battery is in operating order, one unit in conjunction with the battery handles the plant economically and satisfactorily, leaving one engine unit in reserve. In case the battery is out of service, both units can be operated until the battery is ready for service again, and during the light-load period the battery auxiliary takes care of the entire service of the building, without the use of either the engine or generator units.

The engines are operated during the summer compound condensing, by using a cooling tan system and

siphon condenser, as shown in section at the right hand of Fig. 1. With this arrangement the condensing water is cooled by means of the 72 inch ventilating fan, which is in operation during the entire 10 hour run of the plant, and is used for ventilating the building. It was thought advisable to utilize the air from this fan for cooling the water, inasmuch as the energy for driving the fan had to be produced, and utilizing the air from the fan would not entail any additional expenditure of energy upon the plant over that required under ordinary conditions. The condenser is placed near the ceiling of the boiler room and delivers into the standpipe extending downward into a pit about 25 feet. From the bottom of the pit a direct acting deep well pump lifts the water and delivers it to the cooling pans. From the cooling pans the water reaches through suitable piping the cistern shown in Fig. 1. From this cistern the injection pipe from the condenser leads. For this reason the plant will operate about six months of the year compound condensing, and during the balance of the year compound non-condensing, when the steam from the engines will be run into the mains of the building and used for steam heating.

Fig. 6 represents the load diagram of this plant, the parallelogram *A, B, C, D*, representing the total capacity in kilowatt hours of one of the generator units, assuming that the unit starts at 7 o'clock A. M. and operates until 11 o'clock P. M. The line *a, b, c, d, e, f, g, h, i, j, k, l, m*, represents the load line or energy required by the building during the same period. That portion of the diagram shaded with lines inclining to the right at an angle of 45 degrees represents the amount of energy passing into the batteries, while the portion of the diagram represented by shade lines inclining to the left at an angle of 45 degrees represents the amount of energy delivered from the batteries. It will be noticed that from 11 P. M. until 7 A. M. the entire load of the plant is operated by the batteries alone. With this arrangement but two shifts of labor are required, one operating from 7 A. M. until 3 P. M. and the other from 3 P. M. until 11 P. M. From 11 P. M. until morning during the winter the watchman acts as fireman for the boilers to maintain the steam heat in the building. This diagram having previously been illustrated in the *Transactions* of the Institute, November, 1895, it will not further be described here, except to state that the various lines shown on the diagram represent the loads of the different motors, elevators, etc., and the periods during which they operate. The writer hopes in the future to present to the Institute a new diagram representing the actual load lines of the plant, compiled from statistics covering its operation for a considerable length of time, and it will then be interesting to compare the actual diagram with this one, which is the one prepared before starting to design the plant.

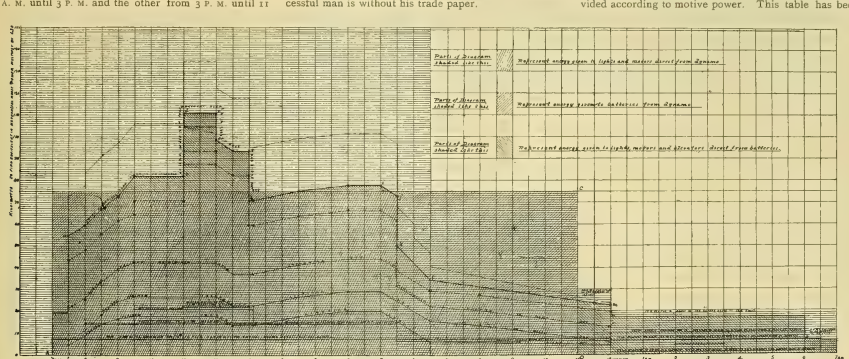


FIG. 6. THE RECONSTRUCTION OF THE PLANT OF THE CHICAGO BOARD OF TRADE

## Progress in Greater New York.

[From the *New York Tribune*.]

An expert in electricity says that it is perfectly feasible to run trains on the elevated road from the Battery to the Harlem in 15 minutes. That electricity can be used advantageously on these roads no one familiar with this agent doubts—no one, that is, except the elevated railroad people themselves. They never do anything for the advantage of the public until they are forced to do it. With an enterprising management electricity would have been in use on these roads two or three years ago, and we should have something approaching rapid transit, without the noise, smoke, cinders, etc., that are inseparable from the use of steam engines.

The deal has been closed for the consolidation of the Capital, Fort Wayne and Edison Electric Light companies of Des Moines, Iowa. For two years the deal has been in process of negotiation. The new concern will control all the electric lighting business of the city. It will close all the plants now in existence and build a new and large one to supply the entire city.

## Business Paper Circulation.

By N. C. Fowler, Jr.

Few trade papers have large circulation. There is little reason why they should. A trade paper cannot have a circulation larger than the number of stores, offices, or factories representing the business.

A few trade papers have circulations exceeding 10,000. Most trade papers do not print over 5,000. Some trade papers print less than 2,000.

The reading circulation of a trade paper is from twice to 10 times as much as the reading circulation of any other class of advertising medium. The good trade paper is read by from one to 50 people. The trade paper is only read by those directly interested in the business. There is no waste to trade paper circulation. Every copy goes into the store, office or factory of a probable buyer.

The reader of a general magazine, or paper, may be only a possible buyer, but every reader of a trade paper must be directly interested in the goods of his trade, or he would not be in that trade. Trade paper circulation is limited to probable buyers. The circulation of all other mediums is limited to possible buyers.

The advertising columns of a good trade paper contain as interesting matter as the reading pages. A trade paper is a mirror of its trade, a sort of reflecting hopper into which is poured suggestions, ideas and fact. The advertising columns of the trade paper are not directories, are not dictionaries, but they are encyclopedias of salable goods and profitable things.

All trade paper readers are not successful, but no successful man is without his trade paper.

The daily paper may be skipped. The magazines may be thrown away, but the business man of brains, sense and profit reads his trade paper, and turns it over to his partners, his clerks and his workmen. The trade paper circulates into the inside of the business pocketbook. It is studied from cover to cover, and read and re-read, for every business man knows that a single paragraph, or a single advertisement, may give him information absolutely necessary in the conduct of his business.

The circulation of a thousand copies, among a thousand actual and constant buyers, will sell more goods, or will assist in the sale of more goods, than will five times the circulation of a general medium.

Trade paper advertising does not take the place of general advertising, nor does general advertising take the place of trade paper advertising. They are different lines, but not opposed to each other.

The maker or seller of something must have a line of trade customers, and these customers are as much interested in his trade paper as he is himself.

The trade paper without circulation hasn't any value, and all things being equal the trade paper of the largest circulation is the best advertising medium, but any trade paper with decent circulation has a right to claim advertising value, because it has it, and has a different kind of value than any other medium.

Circulation counts, even with trade papers, but the circulation of a trade paper cannot be compared with that of one of general circulation, and its value for advertising, inch for inch, is from 10 to 20 times greater, because it goes just where you want it to go, simply because it cannot go anywhere else.

## A Submarine Boat with Claws.

A news paper writer in Baltimore sends out the information that the Lake Submarine company has been organized in that city to build a peculiar vessel with which to locate and explore wrecks at the bottom of the ocean. William T. Malster, of the Columbian Iron Works and Shipbuilding company of Baltimore, is treasurer of the new company. The boat is to be built at these works. Simon Lake of Baltimore is the inventor and president of the company. The boat will be cigar-shaped and built of steel. It will be propelled by steam on the surface and by electricity from storage batteries when submerged. It can be worked at a depth of 150 feet, which will allow it to go in some places out as far as 100 miles from the coast. The trial vessel will be about 40 feet long and 10 or 15 feet in diameter. It will be made small in order to be transported easily to Europe on a steamer after a trial in the port of Baltimore. It will carry a crew of six men, and will be capable of staying on the bottom 40 hours without renewing the air. The openings where the divers will go out to work will be on the bottom, and the water will be kept out of the apartment from which they will leave the boat by air pressure. Powerful electric lights will illuminate the ocean bed for 300 feet around the vessel. When the boat strikes bottom it will run on three wheels, two of which will be furnished with claws so as to act as additional propellers. The company expects not only to raise wreckage, but to discover coral, sponge and other valuable submarine deposits. Mr. Malster and the marine engineers are confident of the success of the scheme.

## Street Railways in Chicago.

The table given herewith shows the number of miles of track and the number of cars operated in the city of Chicago by the different street railway companies, divided according to motive power. This table has been prepared by the *Street Railway Journal* from latest information received directly from the companies' officials. The large electric railway mileage is particularly remarkable, when it is remembered that on January 1, 1893, there were hardly 100 miles of electric railway track in Chicago.

| Company. | Cable | Electric | Horse. | Steam | Total Miles of Track | Cars. |
|---|---|---|---|---|---|---|
| Chicago City Ry. Co. | 35 | 118 | 10 | .. | 163 | 1,785 |
| West Chicago St. R. R. Co. | 31 | 122 | 48 | .. | 201 | 2,000 |
| North Chicago St. R. R. Co. | 17 | 81 | 2 | .. | 100 | 874 |
| Chicago General Ry Co. | .. | 10 | .. | .. | 10 | 32 |
| South Chicago City Ry. Co. | .. | 35 | .. | .. | 35 | 91 |
| Cicero & Proviso Ry. Co. | .. | 50 | .. | .. | 50 | 87 |
| Calumet Electric St. Ry. Co. | .. | 54 | .. | .. | 54 | 186 |
| Chicago & Jefferson Urban Transit Co. | .. | 5 | .. | .. | 5 | .. |
| Chicago North Shore St. Ry. Co. | .. | 17 | .. | .. | 17 | 25 |
| Chicago Electric Transit Co. | .. | 12 | .. | .. | 12 | 40 |
| North Chicago Electric Ry. Co. | .. | 10 | .. | .. | 10 | 20 |
| North Side Electric Ry. Co. | .. | 4 | .. | .. | 4 | .. |
| Ogden Street Ry. Co. | .. | 15 | .. | .. | 15 | .. |
| Lake Street Elevated R. R. Co. | .. | 14 | .. | .. | 14 | 125 |
| Metropolitan West Side Elevated Ry. Co. | .. | 33 | .. | .. | 33 | 155 |
| Chicago South Side Rapid Transit R. R. Co. | .. | .. | .. | 19 | 19 | 180 |
| The Suburban R. R. Co. | .. | 5 | .. | .. | 5 | 24 |
| Total | 83 | 597 | 60 | 19 | 759 | 5,624 |

Under contract and in process of construction in addition to above, about 160 miles of electric

Western Electrician.
EVERY SATURDAY.

PUBLICATION OFFICES:
Suite 510 Marquette Building, CHICAGO.
TELEPHONE, MAIN 1746.

EASTERN OFFICE: 108 TIMES BUILDING, NEW YORK.

Trade Supplied by Western News Co.

COPYRIGHT.—Not only the title but the *entire contents* of each number of the WESTERN ELECTRICIAN are copyrighted. This paper is entered at the Chicago postoffice as mail matter of the second class.

SUBSCRIPTION, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

CORRESPONDENCE relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome. And communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

ADVERTISING.—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West—thoroughly** covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **511** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention

| Date. | Number of Advertising Pages. | Total Number of Pages. | Square Inches of Paid Advertising Matter. |
|---|---|---|---|
| March 4, 1893 | 40 | 56 | 4,145 |
| February 24, 1894 | 52 | 68 | 5,504 |
| May 9, 1896 | 72 | 88 | 7,576 |

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

MANY of those who are following the present controversy over the introduction of the "new light" with which Tesla, Edison and Moore have been experimenting, will have no difficulty in recalling the newspaper claims of several inventors at the time of the introduction of the incandescent lamp. There is a striking resemblance to that old controversy in the present discussion, but we trust that the "new light" will not require so much attention in development as did the incandescent lamp after it had been given to the public with the assurance that its operation was commercially practicable.

RECKLESSNESS on the part of motormen occasionally results in collisions, sometimes with serious consequences. The daily papers of New York last week called attention to a collision between two electric cars in Lenox avenue, at the One Hundred and Sixteenth street junction, in which a conductor and motorman received slight injuries and several passengers were bruised. The cars were heading for the Lenox avenue "Y," each motorman striving to get ahead of the other. The Columbus avenue car got there first, but the Lexington avenue car crashed into its rear end. The conductor of one car was thrown off the platform, and the motorman of the other sustained two slight cuts from flying glass. The platforms of the cars were damaged and several windows in each were broken. An example should be made of such employes.

THERE has been a good deal of talk of late about what Edison and Tesla are about to do in the way of astonishing the world with their discoveries in electric lighting, but thus far there have been no practical results made public. However, we are encouraged in the belief that each of the gentlemen named has something up his sleeve which, after the manner of Herrmann, he proposes to flash upon the public at a propitious moment. With owl-like wisdom an eastern contemporary sagely remarks: "We cannot hesitate to express our positive conviction that the introduction of a more perfect illuminant is near at hand." Well, well! How very definite, to be sure!

In the meantime, while Edison and Tesla are talking about their plans, or rather their friends are talking for them, D. MacFarlan Moore is going ahead and trying to accomplish something in the way of commercial utilization of the vacuum tube light with which Tesla has been experimenting so long. There are many prominent engineers who agree with the views expressed by Mr. Wessels in his communication on this subject, which appears elsewhere in this issue. One cannot read this contribution without feeling that there is cause for criticism of the policy pursued in attaching so much importance to the vague promises that are said to emanate from the "wizard" and the "magician" of the profession, but which many are disposed to consider the product of the lively imagination possessed by a newspaper writer who furnishes popular electrical stories to metropolitan dailies.

STREET railway men will be interested in the result of the litigation between the Chicago City Railway company and the General Electric Railway company, by which the former corporation attempted to prevent competition in its valuable South Side territory. The action was instituted in the name of the attorney-general of the state of Illinois, but no attempt was made to conceal the interest of the Chicago City Railway company and the Western Indiana Railroad company in the proceedings, and the legal representatives of these companies conducted the prosecution of the case. Judge Dunne refused to issue an injunction against the General Electric Railway company, restraining that corporation from proceeding under its ordinance, and in support of this position the court cites the fact that the only persons interested in the granting of the restraining order are the representatives of the transportation companies mentioned. Both parties submitted a great mass of evidence on the question of frontage consents. The affidavits contained allegations of forgery, and many of them were on the question of revocations, but Judge Dunne said in his view of the law applying to the case the affidavits were of no importance. "In the case at bar," said the court, "where the proceedings are brought in the name of the attorney-general, and while presumptively the rights of the people are involved, the facts, circumstances and atmosphere surrounding the case have impressed the court with the conviction that the real parties in interest and the real parties who would suffer by the building of the road in question are not the people of the state of Illinois, but two rival corporations doing a similar business in the same section of the city, whose interests would be imperiled by the building of this road." In view of the magnitude of the interests of these rival corporations the court believes that it is not to be wondered at that the record discloses by numerous affidavits that the Chicago City Railway company has procured revocations, purchased or otherwise, from property owners living along the line of the proposed road. Judge Dunne does not approve the idea of having his court used for the purpose of shutting out legitimate competition. He says: "During the long arguments before this court it was not made to appear to the court that any other property owner or citizen, save and except these companies, would suffer any injury from the building of this road." Judge Dunne concluded that as the question of the validity of the ordinance was raised in the mandamus suit, to which the city was a party, and as the question of the right of the mayor to refuse his signature on the ground that the ordinance was invalid was also raised, the mandamus is a bar to the attorney-general's suit. The decision is one of great importance to companies like the Chicago City Railway, which enjoys a valuable monopoly and does not relish the idea of competition.

AS HAS already been announced, the Senate has taken action upon the Pacific cable project and now the House of Representatives has the subject under consideration. On May 29th the House committee on commerce authorized Mr. Bennett of New York to make a favorable report on a substitute for several bills providing for a cable to Hawaii, Japan and China. Under the terms of the bill, the postmaster-general, in his discretion, may contract with the Pacific Cable company of New York for the construction of a cable between the United States, Hawaii, Japan and China via the Midway Islands. The bill grants the right of way over the United States land and provinces, that the line may be controlled by the president in time of war or other extraordinary emergency. A subsidy of $100,000 is granted. If advantage is taken of the measure the line to the Hawaiian Islands must be completed by January 1, 1898. When the bill was introduced in the House it was accompanied by a report, from which it appears that the cost of the cable from San Francisco to Japan by the route contemplated, together with a repair ship, is estimated at $7,500,000. The subsidy of $100,000 per annum is to be paid for 20 years, and the company is to transmit free of cost for all time the official messages of the government, giving them right of way. The rate for ordinary private dispatches is not to exceed $1.25 per word on messages between the United States and Japan and China and 35 cents per word between the United States and Honolulu. Press rates are not to exceed one-quarter of these charges. The Pacific Cable company is organized with a capital of $10,000,000, and proposes to build the cable by sales of stock and does not propose to issue bonds.

It would seem as if something was bound to come of the persistent agitation for a Pacific cable. Once before the Senate by a large majority sent to the House a bill proposing to pay a company or projected company $250,000 a year during many years for constructing a cable to Hawaii alone. The House did not concur in it, and finally a conference committee proposed a modified plan by which Hawaii should contribute, and the government should be allowed to purchase the cable on specified terms. This was also rejected by the House. Last year, by a vote of 36 to 25, the Senate made an amendment to the consular and diplomatic appropriation bill, setting apart $500,000 for beginning a cable to be laid under government authority, and to belong to the government. This, also, the House did not accept, but the vote may perhaps be considered promising for the success of the present measure so far as the Senate is concerned. Some action must be taken soon if the cable is to be controlled by this country. It is quite certain that if the British lay a line of cable between Australia and the Dominion, the company that does the work will receive government subsidies. That was true, also, of the cable laid between Australia and New Caledonia. English and Canadian interests are moving with the view of controlling the projected enterprise.

## Peru Electric Manufacturing Company's Exhibit.

Few, if any, booths at the electrical exposition in New York attracted more attention than that of the Peru Electric Manufacturing company of Peru, Ind., shown in the accompanying picture. The arrangement was in the shape of an octagon. On entering the booth, on each side, were two large highly polished oak boards, upon which were shown the company's leading special insulators, including various cut-outs, bushings, lamp bases, etc. At the back of booth was also a large board which had a full line of the regular stock of cleats, tubes, rosettes, receptacles, insulators, etc., while on each side of this was arranged Laclede and Hercules primary batteries. One special feature of the exhibit was a new porcelain socket made without a projecting key, which, on one-eighth of a revolving turn, would turn the light on or off. The new catalogue, which is profusely illustrated, was in great demand, and J. T. Stevens, who was in charge of the company's exhibit, was kept responding to requests for "just one more of those beautiful ink-stands." These souvenirs are in the shape of an insulator made by the Peru company, having the usual removable slotted piece for a cap, and mounted on a nickel stand; but the supply was quickly exhausted, so great was the demand.

PERU ELECTRIC MANUFACTURING COMPANY'S EXHIBIT

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the WESTERN ELECTRICIAN.]

A telephone line will be built between Rushford and Highland, Minn.

The Aberdeen Telephone company of Aberdeen, S. D., will begin work on a line to Redfield soon. A line is proposed to Watertown.

The Fairmont Telephone company of Fairmont, Minn., will extend its line to Welcome and Sherburn, Minn., and will connect with Winnebago City, Minn., and other points.

The Northwestern Telephone Exchange company and the Automatic Switch company are applicants for telephone franchises at Luverne, Minn. It is likewise suggested that the city put in an exchange of its own.

The Bell Telephone company has been adjudged in contempt of court in erecting telephone poles in Sheboygan, Wis., in spite of a permanent injunction. The Bell company never secured a franchise in Sheboygan, but was allowed to erect its poles and string its wires. Three years ago the Wisconsin Telephone company (Bell) proposed to improve the system and begun erecting new poles, which the Board of Public Works promptly cut down, the City Council demanding that the company apply for a franchise. The company did so but did not name the rates it would charge. The Northwestern Telephone & Electric company of Milwaukee applied for a franchise and got it, and then the Wisconsin Telephone company began to put in a new exchange, and again applied for a franchise, which was refused. It kept on with the work, and the council applied for an injunction to prevent it from continuing the work and secured a temporary one, which was afterward made permanent. Work was resumed lately, and the court which granted the injunction was asked to construe it, which it did wholly against the company.

The Dane County Telephone company of Madison, Wis., and the La Crosse Telephone company of La Crosse, Wis., have come to an agreement and will construct toll lines to cover western and northwestern Wisconsin.

The city of Owatonna, Minn., invites correspondence on the subject of a franchise for a telephone system. Address Carl K. Bennett.

The North Central Telephone company of Minneapolis is making plans to put in a telephone exchange at Mankato, Minn.

A local telephone company at New Richmond, Wis., secured a franchise and will connect with Hudson, Stillwater and St. Paul.

Patrons at Lanesboro, Minn., complain that the new telephone service is very bad, and suggest that, having secured the cash coupons, the company now lets the line take care of itself.

THE CRANE EXHIBIT.

## Southern Telephone News.

[From the Memphis correspondent of the WESTERN ELECTRICIAN.]

A telephone exchange of 100 instruments has just been put in at Oxford, Miss., by Shinault & Jackson of that place.

Electrical storms have damaged some of the telephone systems put in by independent companies. The Poplar Bluff (Mo.) company lost several instruments and quite a number of drops in its switchboard, while the exchange at Winona, Miss., suffered the loss of quite a quantity of fine wire and the use of a few telephones for several days.

A telephone exchange is being put in at Stuttgart, Ark.

The Southern Telephone Construction company, an independent company of Tallahassee, Fla., is pushing lines out in every direction from that city. It has one line 17 miles long in the direction of the gulf, with three telephones, one to Bradfordville of 14 miles with three instruments, and one to Du Boise, 5 miles, with one instrument. The company has a 100 plug switchboard, with 85 telephones in the city, all working well.

## The Crane Exhibit.

The exhibit of the Crane company of Chicago at the New York electrical exposition, herewith illustrated, consisted of extra heavy gate, globe and angle valves, from 2½ to 24 inches in diameter. The 24 inch valve is a steam valve, and is the only one of this size in New York city. It weighs 6,770 pounds. The Crane company is the only concern in this country that carries these valves in stock. All these extra heavy valves are tested to 800 pounds pressure, and are guaranteed for a working pressure of 250 pounds to the square inch. There were also shown Crane's hard metal globe and angle valves with renewable metallic disks, intended for a working pressure of 250 pounds, and Crane's patent cup check, noiseless back pressure valve, pop safety valve, patent water relief valve, patent low-water alarm, unions with metallic composition gasket, cement, and mocking-bird steam whistles. The exhibit was in charge of Fred. Mitchell.

## Notes from the Exposition.

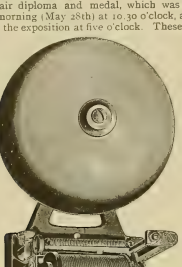
General Superintendent J. F. Blauvelt of the New England Butt company of Providence, R. I., was a prominent visitor at the exposition last week. He re-

ports business as being unusually brisk for this time of year, with bright prospects for the future.

Gould & Eberhardt of Newark, N. J., have been favoring their friends at the exposition with a pretty souvenir—a glass paperweight—which was in great demand.

The historical and loan department was one of the features of the exposition. It has been thronged during the hours of admission to the building, and the handsome collection of portraits shown by W. J. Hammer, and also his case of historical wires (used in important electrical events), have excited much interest.

The Cloabrock Steam Boiler company of Brooklyn, N. Y., showed its usual push and energy in having its World's Fair diploma and medal, which was received Thursday morning (May 28th) at 10 30 o'clock, at headquarters at the exposition at five o'clock. These trophies



VIGILANT SINGLE STROKE AND VIBRATING BELL.

were the object of great interest among the large attendance on that day and the remaining ones of the exposition.

The operative exhibit of the J. H. McEwen Manufacturing company, consisting of a 40 kilowatt Thompson-Ryan multipolar generator directly connected to a 10 by 10 inch McEwen engine, received its due share of attention from the engineering profession and others who visited the show. Its compactness, pleasing outline and smooth running drew many complimentary remarks from the thousands of visitors, and in order to satisfy those who were interested from a practical point of view, a water rheostat was provided so that any desired load up to 50 per cent. beyond the rated capacity of the dynamo could be thrown on or off at will. The normal capacity of the dynamo is 320 amperes at 125 volts, and the test of throwing on or off 450 to 475 amperes instantly with absolutely no sparking and without racing of the engine was a great surprise to all who witnessed the tests. Catalogues describing the machines may be obtained without charge by addressing the company at Church street, between Dey and Cortlandt, New York.

## Vigilant Single Stroke and Vibrating Bell.

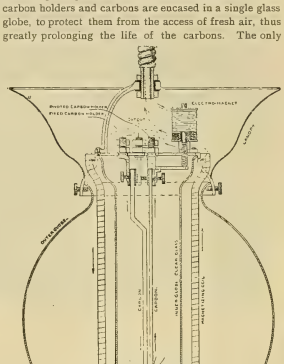
Of the various electrical specialties which are manufactured by Edwards & Co. of One Hundred and Forty-fourth street and Fourth avenue, New York, there is probably none which has met with such marked success as the Vigilant single stroke and vibrating bell, shown in the cut without cover. The hammer rod has a short leverage but a long sweep, enabling it to give rapid and powerful blows. In order to give it the long sweep, the armature is specially arranged so as to be strongly attracted from a greater distance than by the ordinary magnet. The hammer is attached to its rod by a stiff flat spring, allowing it to instantly leave the gong after striking it, causing the signals to be perfectly distinct, no matter how rapidly given. This bell is so arranged that it can be used as a vibrating bell as well as by stroke and also as a continuously ringing bell. It may be wired in series so that any number of bells can be rung at once. The length of stroke and tension of this bell are adjustable.

The St. Louis Amateur Electric club has been organized with 15 members. Otto T. Radke is the president

## Nowotny Arc Lamp.

The cuts accompanying this article show an interesting arc lamp made by the Nowotny Electric company of Cincinnati. Fig. 1 shows the working parts in vertical section; Fig. 2 represents the lamp complete with globe in place, while Fig. 3 gives an idea of the lamp complete with globe suspended.

As will be seen, this lamp is of an entirely new type. The main features of it are as follows: The carbons are placed parallel to each other throughout the entire length which is to be consumed by the arc. The carbons are flat, two flat sides being close to one another. The arc is kept at the tips of the carbons by the use of a magnetic field. This field is generated by a coil which lies in a plane parallel to the axes of both carbons. The carbon holders and carbons are encased in a single glass globe, to protect them from the access of fresh air, thus greatly prolonging the life of the carbons. The only



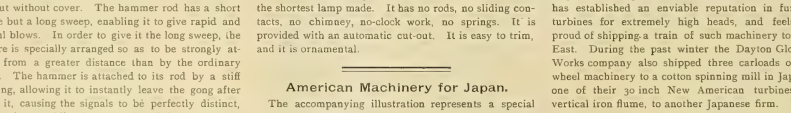
FIGS. 1, 2 AND 3. NOWOTNY ARC LAMP.

moving part of the lamp is one carbon holder, which is pivoted so as to move sufficiently to allow the carbons to come into contact at their tips or to separate to the distance necessary for the required arc. A single solenoid magnet is provided to draw up an arm, fastened to the pivoted carbon holder so as to separate the carbons and form the arc.

This lamp is manufactured for arc, constant potential continuous and alternating current circuits. It is claimed to be simpler, more reliable, give a more uniform and steady light with a less amount of attention and a less consumption of carbon than any other lamp on the market. It will be noticed that this lamp casts no shadow and occupies little room. It is said to be the shortest lamp made. It has no rods, no sliding contacts, no chimney, no clock work, no springs. It is provided with an automatic cut-out. It is easy to trim, and it is ornamental.

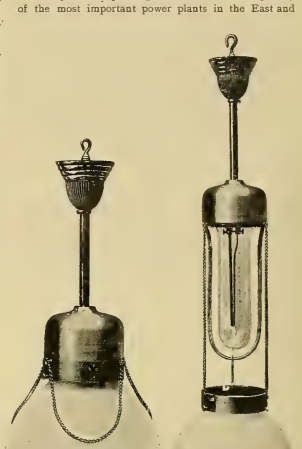
## American Machinery for Japan.

The accompanying illustration represents a special train of turbine wheels and appurtenances recently shipped by a prominent American concern to an influential Japanese company. That the intelligent Japs are fast forging to the front among nations is well illustrated by the fact that their manufacturers are looking for the best and most modern machinery, and are purchasing it in America.



AMERICAN MACHINERY FOR JAPAN.

About eight years ago a party of Japanese called on the old and well-known firm of Stout, Mills & Temple, now the Dayton Globe Iron Works company of Dayton, Ohio, and, after thoroughly investigating their turbine wheels and other machinery, placed a large order with them, to which they have added from time to time. Last summer it was decided to build a new mill, and with this in view I. Murata and M. Kanda of Tokio, Japan, visited this country, determined to purchase what they considered the best turbines that money could buy. After spending two months in visiting many of the most important power plants in the East and



West, including those at Holyoke and Niagara Falls, they returned to Dayton and placed their order with the Dayton Globe Iron Works company. The order included one pair of 45 inch special New American turbines, mounted horizontally, guaranteed to develop 2,204 horse power under 60 feet head; one pair of 42 inch wheels, guaranteed to develop 1,500 horse power under 56 feet head, also mounted horizontally in iron flume, and one 25 inch special New American, placed in horizontal iron flume, guaranteed to develop 350 horse power under 56 feet head.

The entire plant was designed and manufactured to withstand the strain due to these very high heads and to give the best possible results. The Dayton company has established an enviable reputation in furnishing turbines for extremely high heads, and feels justly proud of shipping a train of such machinery to the far East. During the past winter the Dayton Globe Iron Works company also shipped three carloads of water wheel machinery to a cotton spinning mill in Japan, and one of their 30 inch New American turbines, in a vertical iron flume, to another Japanese firm. In addition the company has shipped two of its 25 inch turbines, each in a vertical iron flume, to a silk manufacturing company in Tokio.

Rheubottom & Bond of Union City, Mich., have closed a contract with local capitalists at Athens, Mich., for a complete central station electric lighting and power plant. It is expected that the plant will be in operation in about 70 days.

## Electric Mail Phaeton.

The American Electric Vehicle company of 447 Wabash avenue, Chicago, has embarked in the business of manufacturing, selling and renting electrically propelled carriages. It is turning out handsomely finished vehicles, furnished with light and improved batteries and motors and especially devised braking and steering gear. This company is backed by ample means and has command of excellent mechanical and electrical skill. Henry Potwin is president, F. S. Culver vice-president, C. E. Corrigan general manager and treasurer, and C. E. Woods secretary.

The handsome carriage shown in the illustration is an electric mail phaeton. The departure in design of this vehicle from the ordinary mail phaeton is so slight that with the motors removed and a pole inserted for horses, one would hardly think the vehicle was designed for anything else. It has an equipment of two two horse power motors at a normal working rate which can be momentarily run up to six or seven horse power. The motors are connected one on either hind wheel independently, and are run in series or parallel, giving variations of speed. The special feature of these motors is that they are dust and water-proof, and are especially designed for this class of work in all their electrical proportions.

The battery equipment consists of 32 180 ampere-hour cells made by the Syracuse Storage Battery company, which are grouped in series or parallel by a controller, and, working in conjunction with the motors, make possible five different speeds.

The vehicle is supplied with two brakes—one a band brake applied to the sheave on the shaft of the sprocket wheel; the other an emergency brake which operates directly on the tires. The arrangement of the mechanism in the latter brake is such that the act of putting it on not only cuts the current off from the motors, but automatically sets the controller back to the starting point. The utility of this patented arrangement as well as the necessity of it can at once be understood. The maximum speed of the vehicle is 15 miles an hour. The batteries weigh only 1,000 pounds, and will give a continuous normal six or seven horse power service.

The rear seat is designed to carry two people and is removable when not needed. The steering gear of the vehicle is instantaneous in its resistance and self-locking in a mutual adjustment of the steering lever to the will of the operator.

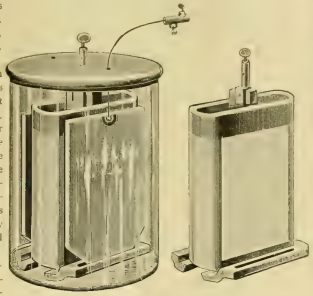
## The Wheelock Battery.

It is claimed by J. H. Bunnell & Co. of New York for the Wheelock battery, herewith illustrated, that its low cost per charge of solutions, its simple parts, commercially obtainable anywhere, and the strength of current economically produced by each cell, make it the most practical, handy and useful primary battery yet introduced for motors, electric fans, sewing machines, dental tools, small boat propellers, battery phonographs, etc. For induction coils, especially in X-ray work, and for telephones, electro-plating, temporary arc and incandescent lighting, gas lighting, gas engines, railway signaling, power bells, and all experimentation requiring reliable power it is well adapted. The six by eight inch size (capacity 100 ampere-hours) delivers from two to 15 amperes, as may be required, without polarizing under strain, whether one minute's work or five hours' work, at a time. On open circuit it stands unchanged for two months, ready at all times to deliver its full power for minutes or hours.

The special features of advantage in the mechanical construction of this battery are: Simple parts of ordinary inexpensive battery materials commercially obtainable at electrical supply depots; flat-rolled zincs which are kept automatically amalgamated more perfectly than is possible with bent cylinder zincs making highest economy in waste of zinc; small carbon surface required, which is obtained with common inexpensive carbon plates combined with but one simple binding post; common oblong porous cup especially prepared and treated so as to be indestructible in strong acids and give perfect action as diaphragm; ordinary commercial glass jars, and strong acid solutions of the cheapest chemicals known in battery use, sulphuric acid and chromic salts, with water.

## Electricity for Hiccoughs.

Aggravated cases of persistent hiccoughing, from which no relief can be obtained, are occasionally reported by medical men, and such attacks usually end in death. A patient suffering from this distressing malady —Miss Nettie Trautman of Elizabeth, N. J.—was recently relieved by the application of a current of electricity, and the fact is worthy of note. The treatment resulted in complete cessation of the paroxysms for nearly three-quarters of an hour, and after that the hiccoughs were in much milder form. This was the first relief obtained by the patient, and she was greatly encouraged. The electrical treatment will be continued, and the attending physicians have hope of eventually accomplishing a cure.



THE WHEELOCK BATTERY

# COMMUNICATION.

## Claims of Moore, Tesla and Edison.

*To the Editor of the* WESTERN ELECTRICIAN

In some of the New York papers I recently noticed articles headed "Tesla's Achievements," which would be amusing were they not misleading.

Stripped of ambiguity, they stated Mr. Tesla will, "with the aid of a few more experiments, be able to produce 40 per cent. of light and his perfected (?) bulb gives 10 per cent. of light." We need not concern ourselves with what Mr. Tesla is "going to do," as the outcome of the "few more experiments" is purely speculative.

Five years ago Mr. Tesla announced he would revolutionize the lighting field. The public saw some faint electrical pyrotechnics, then nothing was seen or heard. No wonder the *Mail and Express* of May 22, 1896, concluded: "There is nothing new in Mr. Tesla's work. His light is the same as he showed to the Society of Electrical Engineers five years ago."

In the *Electrical Engineer*, November 13, 1895, I pointed out the constant tendency of the press to credit Mr. Tesla with the achievements of other inventors! No one will begrudge him credit, if any, due for original work actually demonstrated before reliable witnesses; but the articles I am criticizing are misleading in that they credit to Mr. Tesla, Mr. Moore's achievements. If Moore is substituted for Tesla, the articles will be fairly accurate, if all reference to what is "going to be" is omitted.

The absence of filaments in the tubes is mentioned. The fact cannot be disproved that the first tube-lighted room in this world's history was lighted by Mr. Moore's vibrator and vacuum tubes. Neither Mr. Edison nor Mr. Tesla has shown a room lighted by vacuum tubes up to this time. It was Mr. Moore who first demonstrated commercial etheric lighting. He lighted a room with his tubes over a year ago, as the signed laboratory register and photographs witness. Long before that he lighted the laboratory with lamps and by them obtained clear photographs, along side of which the Tesla pictures published in the April, 1895, *Century* are very obscure. Before the *Century* article appeared I showed Mr. Moore's photographs to prominent electrical engineers.

Mr. Moore alone is entitled to the credit of having discovered new fundamental principles and made them operative. In this credit neither Mr. Edison nor Mr. Tesla is justly entitled to share. Yet the dailies are devoting much space to what is "going to be" and ignoring what is. They head articles "Edison and Tesla Rivals" and shut their eyes to the fact that Mr. Moore is the only one who has shown a tube-lighted room. They print accounts of what "will be," but Mr. Moore demonstrates nightly what is.

The unfounded advertising Mr. Tesla is getting is based upon the *Electrical Review* article of May 20, 1896. That article says that the *Review's* representative saw Tesla's tube. Did others see it? It is proper to inquire

First—Was the representative (name not given) a qualified electrical engineer, capable of judging, or merely a non-technical journalist?

Second—Who made the test of power said to be consumed?

Third—How was the illuminating capacity of the tube measured?

Fourth—Was the light diffused for any length of time, or evanescent?

Fifth—Did the light work on alternating and direct circuits, or only on one of them?

Sixth—How much power was used?

Seventh—Is the system practical? It is well known that in Mr. Tesla's experiments five years ago such enormous voltages were used as made them absolutely useless for any but laboratory use. Moreover (discarding the factor of danger), the cost of insulation would be ruinous, even if, as was not the case, commercial results had been obtained.

Assuming, however, that all the articles stated was true, why has Mr. Tesla not publicly shown his tube? Why is he not present at the electrical show? If prevented from coming, why does he not send a representative with the tube? He never had a better chance than the show affords. As Mr. Edison said, "Moore is showing his light and I will show mine. Let Tesla come along and show his. What counts in the world is the man who produces, not the man who talks."

Against Mr. Tesla's statement of what he is "going to

ELECTRIC MAIL PHAETON

do" the discriminating electrical public will place what Mr. Moore actually did and is doing. Mr. Tesla lectured in 1891 and has shown absolutely nothing since. Mr Moore's record follows:

1891. Mr. Moore claimed he could produce better results than Mr. Tesla showed in his lecture.

1893, Sept. 20. Mr. Moore read his paper before the American Institute of Electrical Engineers on "A New Method for the Control of Electric Energy." Discussion followed, and the paper was printed in the Institute's *Transactions*.

1894, April 1. Mr. Moore showed fine photographs from unretouched negatives taken by his lamps.

1894, July. Mr. Moore's article on "The Light of the Future" appeared in *Cassier's Magazine*, nine months ahead of the Tesla (*Century*) article.

1895, May. Mr. Moore lighted a room in his laboratory with vacuum tubes for the first time in history.

1895, December. Mr. Moore was photographed by his tubes and a full-page reproduction appeared in the *Electrical Engineer*, New York, the *Electrical Review*, London, and elsewhere.

1896, April 22. Mr. Moore lectured before the American Institute of Electrical Engineers on "Recent Developments in Vacuum Tube Lighting," and showed many forms of lamps and tubes, closing by lighting the hall with 27 vacuum tubes. The photograph of the hall, taken by those tubes after a five-minute exposure, from an unretouched negative, appeared in the *Electrical Engineer* on May 5, 1896.

1896, May 4. Mr. Moore lighted up Governor Morton by a frame of seven feet six inch tubes as he opened the electrical exposition, and showed the signs "N. E. L. A." and "Let There Be Light" above Governor's Morton's head.

1896, May 6. Mr. Moore lectured under the auspices of the National Electric Light association (President Wilmerding presiding) and lighted the stage with his vacuum tubes.

1896, May 16. Mr. Moore lighted his tubes in the form of flying arrows, and kept them lighted while Dr. Depew made his speech.

1896, May 20. Mr. Moore participated in the American Institute of Electrical Engineers' discussion of his paper, and, by exhibiting apparatus and tubes, more than proved his claims. He scored a great victory, and the parties who, before making the tests, had denied his claims, admitted Mr. Moore was right and they were wrong.

1896, May 4 and every week-day to date. Mr. Moore's chamber of light has been visited by thousands, who have seen and wondered at his artificial daylight. They make an unimpeachable crowd of witnesses to the great simplicity and inexpensiveness of his apparatus and its low voltage.

Is it not singular (to say the least) that only after Mr. Moore made this unimpeachable record did newspaper articles appear, stating what Messrs. Edison and Tesla were "going to do."

Yet many of the dailies are silent about Mr. Moore, and even the lecture he delivered at the request of the National Electric Light association was only referred to by one of the electrical journals, although the hall was filled with a thousand delegates and others. President Wilmerding held one of the tubes and showed the induction effects when Mr. Moore lighted the stage.

Mr. Moore's demonstrations have greater historic value than press effusions, and these demonstrations cannot be ignored.

Mr. Moore is most willing to continue his public demonstrations after the electrical show closes. Will Mr. Tesla show his tubes at the same time? Let instruments be used by competent electrical experts. Then let the results of the competitive test be published authoritatively. The public will always prefer actual achievements to speculative theories.

The Goebel litigation showed conclusively the unwisdom of allowing incorrect statements to go unrefuted when made. This is one of my reasons for writing this letter. If further argument be needed to demonstrate that Mr. Moore was absolutely first in the vacuum tube lighting field (ahead of Messrs. Edison and Tesla) it will be found in the fact that he secured in the last three years some 20 patents for his inventions in vacuum tube lighting, and further, that a number of his applications are awaiting action in the Patent Office. At no time were there any "references" to Edison or Tesla, and the patents were only issued after Mr. Moore had gone to Washington, set up a miniature laboratory in the United States Patent Office, and proved to the examiners that they were wrong when they originally wrote "each of the claims therefore must be denied on the ground of inoperativeness." Although the examiners said his system would not work by any known law, Mr. Moore proved that it did work, came off a victor at all points and received his patents.

The editor of the *Electrical Review* saw Mr. Moore's laboratory lighted by vacuum tubes in 1894 and was photographed at that time by the light of the tubes. On the day the *Review* published the Tesla article, Mr. Moore appeared before the American Institute of Electrical Engineers and submitted his apparatus for tests. The result of the tests made by such men as Prof. W. A. Anthony, Prof. Nichols of Cornell, Nelson W. Perry and others proved that Mr. Moore had understated rather than overstated, his claims. Let Mr. Tesla produce his tube, face the same searchlight, and if he passes muster, he will get all the credit really due him.

No matter what Mr. Edison, Mr. Tesla or anyone else may produce, the fact remains that to D. MacFarlan Moore alone belongs the credit of first having produced commercial light by means of vacuum tubes.

It is largely to put this fact indisputably on record that I have written this letter.

EDWARD J. WESSELS,
President Moore Electrical company.
*Newark, N. J.*, May 25, 1896.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, May 30.—There has been some newspaper gossip during the week in relation to the possible use of compressed air as a motive power on the street railways of New York and Chicago, but the rumors, which seem to have been put forth for ulterior purposes, were promptly denied.

As a result of the decision of the Appellate Division of the Supreme Court in the rapid transit case, the Rapid Transit commissioners, at their meeting on Monday, suspended all further operations of the board as to routes under consideration, and, it was understood, only deferred placing their resignations in the hands of the mayor so that the Manhattan Elevated Railway company might have an opportunity to file an application for permission to construct its proposed extensions and connections on both sides of the city. The counsel, chief engineer and secretary gave notice that they would make no claim for compensation after May 31st, and the secretary was authorized to surrender the lease of the commission's office in the Postal Telegraph building, in Broadway, on that date. An address to the people of New York was issued, setting forth the reasons which had caused the commission to adopt this course.

According to the last quarterly report of the Brooklyn Elevated Railroad company, there has been a material falling off in the earnings of the company. President Uhlmann was asked how he accounted for the decrease. He said:

The falling off in the earnings of our company can, in a large degree, be attributed to the incomplete condition of the bridge terminals, which cannot accommodate all the people during the rush hours, and consequently turn them to the ferries. We only connect with the Fulton and Broadway ferries, while the trolley companies reach all of the 13 ferries between New York and Brooklyn, and they, of course, got the bulk of the traffic. The speed of the trolley cars is so great that they can fairly compete with the elevated roads. We make a little better time, but that is lost in climbing the stairs to reach our trains. No one seems able to prevent the trolley cars from going at the rate of from 12 to 15 miles an hour. The proposition now before the Board of Aldermen to change the ordinance of 1895 will be just as ineffectual as the existing ordinance, for the companies will certainly defend themselves against a claim for $100, which can only be imposed when an action is brought, and the collection of which will cost twice as much as the possible recovery. We are confident of better results in the future, feeling that, sooner or later, even the influence of the trolley companies cannot withstand popular sentiment, which must rise against this awful slaughter. One remedy to regulate the speed of the trolley will undoubtedly be employed as soon as the attention of the authorities is called to it. That is the enactment of a law compelling every trolley car to be equipped with a speed indicator.

W. F. O.

### Milwaukee, Wis.

MILWAUKEE, May 30.—During the present week two more attempts have been made to settle the street railway strike. F. R. Hannifin and James Morgan, two prominent dry goods dealers of the city, decided that on account of the injury that was being done to the city's business interests some further effort toward a settlement should be made. They accordingly talked with the men and then with the directors of the company, and finally arranged a conference between the contending parties. The company offered to take back a third of the 900 men who went out on the strike and to place the others on the reserve list, giving them work as fast as vacancies occurred. The company stated that in the future it would not discriminate against the old employes, nor would it tolerate a black-list. The company also offered to allow the Amalgamated Association of Street Railway Employes to select the 300 men who were to be taken back at once. These terms were apparently satisfactory to the men except on one point—they asked that the full number of strikers be taken back and that 300 of the number be put to work each week, so that each man would be able to work a third of the time. They all went out together, the men said, and they must all go back together, but they were willing to make a compromise so as to divide what work there might be among their number. Two of the three Milwaukee directors, it is said, agreed to this proposition from the men, but the third Milwaukee director held out, although the men, when the objection was raised that the plan would cause too many to assemble at the barns, replied that all that would be required would be for the foreman, once in each week, to post the names of the men that were to go to work on the morning that the change of crews was necessitated. This conference was the last that Messrs. Hannifin and Morgan arranged, and they gave up the effort to settle the trouble. The proposition of the company was submitted to a meeting of the men, some 800 being present, and it was unanimously declined.

The next development was the appearance upon the scene on Thursday forenoon of Samuel Gompers, president of the American Federation of Labor. His presence was the result of a resolution adopted at a meeting of the strike leaders and a committee representing the Federated Trades Council of Milwaukee. As soon as he reached the city he began to try to make some satisfactory arrangement between the men and the company. After acquainting himself with the situation, he held two conferences with Vice-president Payne of the company, at the latter of which Gov. Upham was present in his capacity as a citizen, but the head of the great labor organization of America, with a membership of 600,000, could do little toward bringing about a settlement. Gompers proposed that the company change its operating system so as to employ three shifts, two for eight hours and one for four hours, the four-hour shift to alternate with the others, so that all might have the same amount of work. This change, Mr. Gompers said, would enable the company to give 600 of the old men work, and the men would earn an average of $1.26 a day. Mr. Payne was not willing to make the pay of the men so small, but he repeated his offer to take back 300 of the old men and to pay them whether they had work all the time or not. Gompers said that he would rather see the men beg from door to door. Friday evening he addressed a mass meeting which endorsed the position of the men, and he said: "In a just cause, the cause of humanity, I say 'Long live King Boycott.'" Gompers returned to Indianapolis early this morning.

The company is running its cars as though no strike had ever happened. Altogether more than 700 men have been imported from other places to take the places of the strikers. These men, it is stated by the company, came from the following places: Chicago, 150; Minneapolis and St. Paul, 75; Philadelphia, 150; Cleveland, 70; Indianapolis, 60; St. Louis, 80; Grand Rapids, 66; Buffalo, 60. Vice-president Payne has stated that Milwaukee, on account of a public feeling against the company, was chosen as the place for beginning a fight against street railway companies generally—a fight by the men for higher wages and easier conditions. If this be the case, the Amalgamated Association of Street Railway Employes has really received a severe blow in the Milwaukee affair, for not only have the strikers failed to obtain a single one of the important demands that they made, but they cannot return to work—that is, two-thirds of them cannot do so—under the old conditions. There is no doubt, however, that the company has received aid from companies in other cities which regarded the strike here as a sort of a test. The places of the strikers could probably not have been filled so readily with experienced men had not the Milwaukee company had some warm friends among street railway owners elsewhere. There may be some connection between this phase of the situation and General Manager Wyman's trip to eastern cities a short time before the strike.

The buses operated by the strikers and their sympathizers continue to do a large business and the effect of the competition upon the company must be such as to make its virtual victory over the men a rather costly one. Since the extra policemen have been taken off, there has been more damage to cars, windows being smashed at various points in the city. The company's total loss by reason of injury inflicted upon its property may reach $40,000. Some time ago the company notified the city that it would be held responsible for all damage to its property by mobs, and it is said to be the intention of the company to hold the city responsible for every cent of damage that it has sustained in this way. The company has an itemized statement of such losses and the statement is destined for the hands of the company's attorneys.

C.

## PERSONAL

Frank X. Cicott, manager of the railway department for the Pettingill-Andrews company of Boston and New York, will sail for Europe on the American line steamer New York, to be absent about two months.

W. J. Morrison, who for several years was New York state agent of the Fort Wayne Electric corporation, has accepted the position of general agent for the Ball Electric Light company of New York. He is one of the best known salesmen in the electrical business, and has held his acquaintanceship and trade by fair dealing. He will be heard from during his connection with the Ball Electric Light company.

## ELECTRIC RAILWAYS.

Chester B. French, promoter of the Detroit and St. Clair river electric road, which is partially built between Chesterfield and Marine City, says that the project has been by no means abandoned. He hopes to see the road completed before July.

The Syracuse (N. Y.) Rapid Transit Railway company was incorporated on May 21st. It is believed to be a reorganization of the Syracuse street roads. It announces that the length of its lines is to be 57½ miles. The capital stock is $4,000,000, consisting of $1,250,000 preferred and $2,750,000 common stock. The preferred is entitled to a six per cent. non-cumulative dividend out of the company's net earnings before anything shall be paid on the common stock. The directors are John Young of Jersey City, Ansel L. White, George F. Brown, David H. Darling, John B. Summerfield, Edward T. Perine, William H. Chesebrough, Jr., and S. B. Lawrence of New York city, and Edward H. Tobey of Brooklyn.

## MISCELLANEOUS.

B. S. Tolan has been appointed architect for a new court-house, to cost $500,000, for Allen county, to be built in Fort Wayne, Ind.

The fourteenth annual catalogue of the Rose Polytechnic Institute of Terra Haute, Ind., shows that this excellent institution is doing good work and flourishing. The school has 113 students, of whom a large proportion are in the electrical department.

## TRADE NEWS.

The Weston Engine company, owing to the recent fire, has leased temporary quarters in Corning, N. Y., where it will be able to fill all contracts except those for automatic engines. The company expects to rebuild, but will probably lease a foundry in the meantime.

Edwards & Co. of One Hundred and Forty-fourth street and Fourth avenue, New York, have issued a new catalogue profusely illustrating their various electrical specialties. Since their previous catalogue was issued they have added largely to the number of articles manufactured, which now includes about everything one could desire in this line of goods. This catalogue will be of much benefit to purchasing agents in the electrical business.

Among users of the Crane company's high pressure valves in the West are the following named: Detroit Citizens' Street Railway, Detroit, Mich.; Illinois Steel company, South Chicago, Ill.; Illinois Steel company, Joliet, Ill.; Oakwood Street Railway company, Dayton, Ohio; Kansas City Stock Yards, Kansas City, Mo.; Star Electric company, Dubuque, Iowa; Joseph McWilliams & Co., Louisville, Ky.; Los Angeles Traction company, Los Angeles, Cal.; Board of Trade building, Chicago, Ill.; Minneapolis General Electric company, Minneapolis, Minn.

A fine new catalogue shows the complete line of overhead line material for electric railways manufactured by the Creaghead Engineering company of Cincinnati. The design of this material is the result of experience in the construction of electric railways, and the devices have been tested and approved by some of the best railway experts and superintendents. As far as is consistent with good practice, the devices have been made light in weight. The material in the parts is distributed so as to give proper strength and present a neat and workmanlike appearance.

In "The Fashioning of a Lamp" Maurice Hyde Cleveland makes an attractive story of the manufacture of incandescent lamps as revealed by a visit to the factory of the Bryan-Marsh company at Marlborough, Mass. Mr. Cleveland begins his researches "in the darksome days of ancient Egypt, fourteen hundred years before Christ," but he speedily gets down to the nineteenth century as to time and the United States as to place and makes a readable article. The greater part of the pamphlet is taken up by a well arranged catalogue of the complete series of lamps made by the company which has its main office at 140 Liberty street, New York.

Roy Macdonald, Jr., 2221 St Catherine street, Montreal, Canada, is "holding his own" in the mica industry, having had 22 years' experience in that line. He has opened up two new mines which are turning out a superior class of mica, hard and close in texture, which will compare favorably with the best. He is also opening a mine which is to produce a white mica, and this will be looked forward to with much interest by all jobbers and consumers. Mr. Macdonald is prepared to supply any quantity in any size of sheet. His factory has been enlarged to be prepared for any emergency.

The advantages of the Webster vacuum system of steam heating are very attractively set forth in a neat pamphlet issued by Warren Webster & Co. of Camden, N. J., under whose patents the system is operated. This system is guaranteed to be without back pressure upon the engine, embracing combined thermostatic, water and air relief valve improvements. The members of this firm are specialists in examining steam plants where increased efficiency and greater economy is desired, in heating feed water for steam boilers, also warming buildings within a radius of 2,000 feet from power house by the utilization of exhaust steam, without back pressure upon the engines, irrespective of present heaters or systems employed.

The Standard Underground Cable company announces that it has completed arrangements whereby it is enabled to undertake the installation of underground systems of all descriptions, complete in every detail. The company's reputation for the successful installation of underground cables in any quantity is so well established as to need no comment. It will be learned with interest, however, by wire-using companies that the Standard company is now ready to furnish and install the conduits as well. The company has established a conduit department, with F. S. Vicle at its head as manager. Mr. Viele is an experienced, practical engineer in conduit and cable construction, and, with the high reputation of the company for construction work of all kinds, the conduit department is sure to prove an important and successful branch of the business.

The I-T-E automatic magnetic circuit breakers, manufactured by the Cutter Electrical & Manufacturing company of Philadelphia, have been received with great favor by engineers. The underwriters of the cities of New York, Chicago, Boston and Philadelphia have approved them, and unreliable methods practiced in the matter of circuit protection will soon, it is hoped, become a thing of the past. As is usually the case in all inventions and improvements, the "thing" or feature is some little modification or development which is apparent at first glance, and which, seemingly, should have been thought of before. The letters "I-T-E" represent the salient feature of the automatic magnetic circuit breakers—inverse time element—the basic principle entering into the construction of the device, that is, a circuit protected by this circuit breaker is opened in less and less time as the circuit approaches nearer and nearer a short-circuit. The circuit breakers are made for switchboards (railway, light and power) motors, house service and storage batteries on direct and alternating circuits. The company issues an I-T-E catalogue which will repay careful reading and will be sent to all interested in this important subject upon application.

## BUSINESS.

A. O. Schoonmaker, 158 William street, New York, makes a specialty of stamping solid sheet mica washers and has facilities to furnish any size wanted promptly. He will build up to any thickness required.

The Watertown Engine company has opened an office at 39 Cortlandt street, New York, in charge of L. Copleston. The company has just issued a handsome folder briefly setting forth the merits of its engines.

Recovering from its recent disastrous fire in Brooklyn, the Porter Standard Motor company is now newly equipped, with better facilities than ever before for the manufacture of high-grade battery motors. The company has removed to Lebanon, N. H.

The National Ore & Reduction company of St. Louis, in its National matte smelter, claims to have a practical and simple method of matting sulphide ores, such as nickel, copper, gold and silver ores, in localities where lead ores and fuels are scarce and almost unattainable.

A late list of the recording volt, watt and ampere meters made by the Bristol company of Waterbury, Conn., shows the extent of this company's business in electrical instruments. Automatic recording instruments have many advantages for use in central stations and give an exact indication of the work of the station at all hours. Users of the recording instruments speak very highly of them.

A classified list of the students of the International Correspondence Schools of Scranton, Pa., shows that among 17,000 students engaged in over a hundred occupations fully a third are enrolled in the electrical courses or courses in which electricity forms a part. The mechanical-electrical scholarship is intended for those engaged in designing and manufacturing electrical machinery and appliances. The electrical power and lighting scholarship is intended for men engaged in installing and operating electrical machinery. In these schools instruction is given entirely by correspondence.

The Julius Andrae & Sons company of Milwaukee has just secured the entire electrical and steam plant contract for the state prison at Waupun, Wis. Milwaukee work under way by this company is as follows: Wiring the residence of John W. Mariner, furnishing and putting in complete the entire electric and fixture work in the new Boston department store; doing all the wiring and furnishing all the fixtures for the Western Union Telegraph company's office; wiring and doing all the electric bell and annunciator work in the new residences of Dr. Maerckler and J. W. Wittmeyer.

The Western Telephone Construction company of Chicago has shipped a 400 telephone exchange equipment to the Mutual Telephone company of Petersburg, Va., to take the place of Mason-Maxwell apparatus. The company reports a large increase in orders. Recent contracts are: Du Quoin, Ill., 100 telephones; Ashland, Ky., 150 telephones; Bellaire, O., 75 telephones; Metropolis, Ill., 60 telephones; Oberlin, O., 150 telephones; Wauseon, O., 100 telephones; Barnesville, O., 100 exchange equipment; Rochester, N. Y., 50 telephone equipment; Ticonderoga, N. Y., 150 exchange outfit.

The Garlock Packing company, Palmyra, N. Y., reports that the extensive addition to its factories is now nearly completed. The company is now manufacturing waterproof hydraulic and high-pressure piston packings in both ring and spiral forms. It is receiving for both of these packings a constantly increasing trade and is rushed with orders for all kinds of the various packings at both the Palmyra, N. Y., and Rome, Ga., factories. Engineers who are not users of the Garlock packing should send in a small trial order which will convince them of the superiority of Garlock packings.

The Electric Appliance company has brought out two more clever and original advertising schemes. One is in the shape of a pad or tablet of blank forms on which can be recorded 30-minute readings of the number of amperes as shown by the station ammeter. This gives a permanent record of the station load at 30-minute intervals during the entire 24 hours. The other scheme is a complete set of architect's specifications for electric wiring, which can be used as a form for making contracts for electric wiring. These specifications have been carefully drawn by a well known consulting electrical engineer. The Electric Appliance company is prepared to furnish either or both of these blanks free on application.

Anything bearing the stamp of the C. W. Hunt company of 45 Broadway, New York, is sure to be of approved excellence and accuracy. Nothing words of praise can be bestowed on the company's late work on "Manila Rope for Transmission and Hoisting," which well deserves the sub-title—"A Brief Treatise for Engineers on Ropes Used for the Transmission of Power, Together with Formulæ, Tables and Data Useful in Mill Engineering"—although the reader's attention is unobstrusively directed to the merits of the "Stevedore" brand of rope for power transmission and other purposes. A great deal of valuable information—much of it exceedingly interesting as well—is contained in this book, which should find a place in every engineer's library.

The Ohio Electric Works of Cleveland, Ohio, have begun the manufacture of an electric bicycle lamp that is warranted to burn, to give a light and to last. In its general appearance the new lamp does not differ much from the oil lamps, except that it is narrower and the reflector which holds the lamp projects farther from the surface. The body of the lamp resembles a small electric cell more than anything else, and that is really what it is. It is attached to the front of the bicycle in the ordinary position. The construction of the lamp is so simple that anyone can recharge the battery without difficulty. The light is furnished by a small incandescent lamp backed by a powerful reflector. The annoyances occasioned by grease, oil and gas are done away with. There is no smell and no smoke, and one charge of the battery is said to be sufficient to maintain the light for hours.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued May 26, 1896.*

560,652. Electro-magnetic Motor. Frederick M. Schmidt, Brooklyn, N. Y. Application filed January 18, 1896.

The inventing comprises an armature of comparatively feeble power mounted to oscillate in the face of the poles of an electro-magnet between spring-buffers which limit its swing, a commutator shifted by the armature at points near the extremes of its movement, a ratchet and pawl for converting the oscillating motion of the armature into rotary motion, and reducing gears between the ratchet and the fan-spindle, whereby a slow and practically continuous movement of the fan is maintained.

560 658. Controller for Electric Cars. Elmer A. Sperry, Cleveland, Ohio. Application filed March 20, 1896.

The first claim is for the combination with a controller cylinder of a switch for reversing the armature connections, a reversing device arranged to actuate the reversing switch, a connecting rod arranged to be actuated by the cylinder, and means for engaging the rod with and disengaging it from the rocking device.

560,667. Incandescent Lamp Socket. Herbert C. Wirt, Schenectady, N. Y. Application filed February 17, 1896.

A molded base for incandescent lamp sockets is described, formed with a central transverse recess or open portion extending from top to bottom and clear across the base to receive the key frame, its shaft, key and spring, and projections adapted to abut against the contact portion of an incandescent lamp, and having their ends lying in the same plane at such a distance from the key when the latter is in place in the base as to insure electrical connection.

560,671. Electric Arc Lamp. Thomas E. Adams, Cleveland, Ohio. Application filed January 4, 1896.

One feature is the combination with the lamp arm and an arc-inclosing globe, of a rigid plate projecting laterally from the lamp arm and constituting a cover for the arc-inclosing globe, the plate or cover having a hole for the passage of the upper carbon, and a spring constructed to force the globe against the plate or cover.

560,678 Electric Railway. Henry Brandenburg, Chicago, Ill. Application filed March 11, 1895

The slotted tubular conductor, the trolley having the beaded plate, and a sleeve carrying a multiplicity of contacts mounted on the head.

560,679. Apparatus for Producing Musical Sounds by Electricity. George Breed, Philadelphia, Pa. Application filed November 20, 1894.

A series of musical strings is employed, in combination with a series of electro-magnets arranged in parallel and connected with a source of electric energy, and a system of two-way switches controlling the current to the electro-magnets.

560,703. Electric Valve. Charles L. Fortier, Chicago, Ill. Application filed October 10, 1892.

A polarized armature is pivoted within the case in the field of the electro-magnet, and provided opposite the seats and openings in the connections with valves which are adjustably connected with the armature so as to admit of varying the distance between them and their seats, whereby sticking of the armature to the cores of the magnet is prevented and the closing of the valves is insured.

560,721. Electric Railway. Edward H. Johnson, New York, and Robert Lundell, Brooklyn, N. Y. Application filed October 15, 1895.

The method of disconnecting a sectional trolley conductor from circuit with a current main or lead when the circuit connections between the conductor and main are due to leaking currents consists in conveying the leaking currents around the switching mechanism, and thereby causing the switching mechanism to assume its normal or open position.

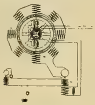
560,735. Alternating Current Generator. Walter S. Moody, Lynn, Mass. Application filed January 17, 1896.

This method of compounding alternating current dynamo-electric machines for change of potential under change of load consists in supplying to the field magnets current from an armature revolving in a compound field of force independent of the armature itself, part of such field of force supplied by a separate excitation substantially fixed in amount, and part by a commuted current derived from the main machine.

560,737. Commutator Brush. William H. Morgan, Alliance, Ohio. Application filed February 20, 1895.

Several sets of contact plates are pivotally connected at one end to the frame, and yieldingly connected at the other end to the frame, the yielding ends of the sets of plates alternating with the pivoted ends.

560,751. Electric Brake. William B. Potter, Schenectady, N. Y. Application filed March 13, 1896.



NO. 560,735.

In an electric braking apparatus, the combination of a controlling switch, a reversing switch and a braking switch having two sets of contacts corresponding respectively to the forward and backward running positions of the reversing switch, and means for locking the switches so that only one of the switches may be operated at one time, the interlocking means being so arranged that the braking switch may be operated only in a direction corresponding to the proper position of the reversing switch.

560,757. Busy Signal for Telephone Lines. Charles E. Scribner, Chicago, Ill. Application filed August 17, 1895.

A switch lever of a telephone set, an indicator adapted to be set by the movement of the lever, a detent controlling the movement of the indicator, and an electro-magnet acting upon the detent are employed.

560,761. Telephone Circuit. John S. Stone, Boston, Mass. Application filed March 13, 1896.

A generator and a relay are arranged in a permanent bridge between the circuit conductors, the generator being interposed between the coils of the relay, and a local circuit including a battery, a line lamp signal controlled by the relay, and means for shunting the signal when connection is made with the line.

560,762. Telephone Circuit and Apparatus. John S. Stone, Boston, Mass. Application filed April 2, 1896.

A plurality of pairs of telephone circuits is connected in series, each including a telephone receiver and a telephone transmitter supplied with current from a common battery. There are also combined impedance and repeating coils in series in each of the pairs of circuits and in series with the battery.

560,763. Automatic Heat Regulating Device. John V. Stout, Easton, Pa. Application filed June 6, 1895.

Included in the arrangement are an electric motor for controlling and actuating the auxiliary valve and a thermostat serving to control the action of the electric motor.

560,766. Controllable Switch Box. John Van Vleck, New York, N. Y. Application filed January 3, 1896.

An inclosing case is provided for an electric mechanism having contacts with a detachable cover which has its inner surface inwardly inclined to a downwardly projecting point so disposed that moisture condensing on the surface and dropping from the point will not fall upon the contacts.

560,772. Electrical Distributing System. Richard R. Bowker, Brooklyn, N. Y. Application filed February 27, 1896.

The system comprises a supply station, a controllable switch box at a distance therefrom, a street conductor leading from the station to the switch-box, two branch street conductors also leading from the switch-box, and a means of controlling the switch-box from the station, whereby the supply current may be directed into either of the branch conductors.

560,792. Electric Arc Lamp. John H. J. Haines, New York, N. Y., and Alexander B. Fernald, Jersey City, N. J. Application filed January 7, 1896.

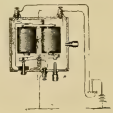
The combination with the feed magnet, of the lever operated thereby, the clutch mechanism mounted to move freely and to rotate upon studs projecting from the lever, and a fixed releasing device for the clutch mechanism.

560,807. Conduit Electric Railway. Walter Lobach, Chicago, Ill. Application filed April 23, 1894.

In an electric railway, the combination with a conduit of an insulating liquid heavier than water contained therein, an electric conductor immersed in the liquid, and a contact device carried upon the car and adapted to make contact with the conductor.

560,821. Electric Cut-out. John C. Reynolds, New York, N. Y. Application filed January 25, 1896.

An open ended hollowed casing of insulating material is provided with studs of insulating material in the hollow thereof for the attachment of the conductors, a cover of insulating material is adapted to press upon and clamp together the conductors at each of the respective studs, so as to effect electrical contact between the terminal and fuse wire at the stud, and means are provided for binding the cover firmly to the casing.



NO. 560,703.

560,841. Current Collector for Electric Railways. Albert N. Connett, Washington, D. C. Application filed January 17, 1896.

This is a traveling contact or current collector for electric railways, comprising a hanger, oppositely disposed contact shoes, an interposed toggle, and a spring connection between the toggle and hanger.

560,845. Telephone Exchange System. William W. Dean, St. Louis, Mo. Application filed April 3, 1896.

The combination is claimed with a metallic circuit, having telephones connected in different portions thereof, of a retardation coil bridged between the sides of the circuit between the telephones, the retardation coil being provided with two uniform coils of wire, the coils surrounding the core of the induction coil and being laid about the same, side by side, the inner ends of the coils being united, whereby an electrical connection is formed, through the medium of the coils, between the sides of the circuit, while the alternating or voice currents are prevented from being shunted across the connection.

560,852. Static Electrical Machine. Charles M. Hollopeter, Fostoria, Ohio. Application filed July 19, 1895.

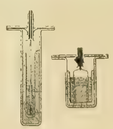
The device comprises a rectangular frame, consisting of opposite insulated pairs of frame conductor rods, the stationary and revolving generator plates mounted within the frame, and swinging adjustable prime conductors pivotally connected respectively with the opposite pairs of frame rods.

560,861. Multiple Telephony. Frank A. Pickernell, Newark, N. J., and Frederic S. Perrin, New York, N. Y. Application filed March 21, 1896.

Claim one is given: The combination of a metallic telephone line circuit, a second main metallic telephone circuit having for one of its sides or conductors a portion of both of the conductors in parallel of the first circuit, and a double-wound electro-magnetic resistance or choking coil having its two woundings serially but opposingly connected in the conductors of the said first circuit at points beyond or outside the portion of them which forms one side of the second circuit, and adapted thereby to offer a minimum impedance to currents flowing through the conductors of the said first circuit in series, and a maximum impedance to currents flowing through the same conductors in parallel.

560,894. Current Collector for Electric Railways. Albert N. Connett, Washington, D. C., and Jacob S. Detrick, Baltimore, Md. Application filed January 17, 1896.

The invention consists of the combination with the hanger, the yielding shoes, and insulating blocks of the pivoted links, bearing blocks projecting from the hanger, pivot rods, and sleeves loosely encircling the rods.



NO 560,807.

560,903. Electric Railway. William H. Jordan, Brooklyn, N. Y. Application filed January 17, 1896.

One claim follows: In an electric railway, the combination with a working conductor having insulated sections, of a feed-wire extending along the line and connected at intervals with the working conductor, and two connections between the feed-wire and the insulated sections, one of said connection containing signaling devices, and the other connections being of high resistance, whereby when a car enters an insulated section the current for the motor will pass through the signaling devices and operate the same.

560,917. Elevated Electric Railway Jas. H. McGurty, Jersey City, N. J. Application filed June 13, 1895.

In an electric railway, the combination is claimed with a track, an electric conductor, and an electrically propelled car, of a switch provided on the car and adapted to be moved horizontally, a trip disposed at one side of the track to engage with and move the switch laterally to break the circuit, and a second trip arranged at the opposite side of the track to engage with the switch and move it laterally to a normal position and establish the circuit.

560,921. Thermometric Circuit Closer or Alarm. Richard Pearson, London, England. Application filed September 3, 1895.

A thermostatic electric circuit closer is described, consisting of a thermometer containing a mercurial column, two platinum wires forming the terminal contacts of the circuit, and both entering the thermometer bore at such a point that neither is in contact with the mercury column at normal temperatures, and an insulating fluid contained in the bore between the mercury and the contacts, the insulating fluid consisting of creosote free of fatty matter, and having a boiling point of about 400 degrees Fahrenheit.

560,931. Electrolytical Apparatus. William S. Rawson, London, England. Application filed March 21, 1895.

Electrolytical apparatus consisting of a tank for containing liquid electrolyte, a perforated barrel of non-conducting material mounted to revolve on a shaft therein, a perforated or network metal cylinder fixed on but insulated from the shaft, and connected by a suitable conductor to the positive terminal of a source of electricity, and bent metal rods fixed at intervals in the interior of the barrel, and connected through a commutating device to the negative terminal of the source of electricity.

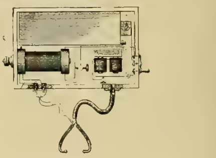
560,988. Electric Railway System. Nicholas J. Halpine, U. S. Navy. Application filed February 1, 1893.

The combination with the main conductor and electro-magnetic trolley of a storage battery receiving its charging current from the main conductor, and connected electrically with the lamps carried by the car and with the electro-magnets of the trolley.

561,002. System of Electric Distribution. Pierre O. Keilholtz, Baltimore, Md. Application filed February 29, 1896.

A system comprising a motor and a dynamo, the field of the motor being in circuit with the armature of the dynamo, auxiliary windings on the motor field in series with the field of the dynamo, and means for revolving the armatures of the motor and dynamo in unison.

561,046. Electro-therapeutic Apparatus for Treating Deafness. Samuel J. Collier, Chicago, Ill. Application filed October 22, 1895.



NO. 561,046.

A device for treating deafness, comprising a box or case, a galvanic battery, an induction coil and an electro-magnetic sounder, both the coil and sounder being arranged in a box and in a circuit of the same battery, a switch for sending the current to either the induction coil or sounder, or both at the same time, tubular ear-pieces having a tubular connection with the interior of the box, and wires leading from the terminals of the secondary coil to the two ear-pieces.

561,073. Lightning Arrester. William Cooper, Schenectady, N. Y. Application filed September 23, 1895.

The combination is claimed with the air-tight box, of terminals arranged therein, a weak cover provided for the box, one of the terminals being provided upon the box, and the other upon the cover, a gap being provided between the terminals and the cover adapted to be blown off the box when gas is formed by the burning of an arc between the terminals.

RE-ISSUES.

11,542. Electric Locomotive. John C. Henry, Denver, Colo. Application filed February 24, 1896.

In combination with the wheels and axles of a car truck, a frame uniting the wheels and a motor resting by its field magnets on the frame, and having a bearing on its field magnets intermediate of their support on the axles adapted to receive the weight of the car body.

11,543. Electric Locomotive. John C. Henry, Denver, Colo. Application filed February 24, 1896.

In an electric railway car, the combination of a motor, differential power transmitting mechanism from the shaft thereof to a car axle, one element of which may run freely or be arrested in order to control the movement of the car, and a liquid abutment comprising a cylinder, piston and manually-controlled regulating valve connected to the element of the transmitting mechanism.

11,544. Combined Gas and Electric Light Fixture. Luther Stieringer, New York, N. Y. Application filed December 21, 1894.

In a combined gas and electric light fixture, the combination is claimed with a central supporting gas-pipe stem or arm, and one or more gas distributing bodies, of separate arms for gas burners and electric lamps supported by such distributing body or bodies, the arms for electric lamps being closed against the admission of gas thereto.

11,545. Automatic Device for Removing Resistance in Starting Electric Motors, etc. George H. Whittingham, Baltimore, Md. Application filed March 6, 1896.

One claim is given: The combination of a motor, a resistance coil in electrical connection with the armature, a movable contact device in circuit with said coil, a pawl and ratchet operated by the motor armature and adapted to impart to the contact device a limited movement in the direction which reduces the resistance of the armature circuit, and means for disengaging the pawl and ratchet when the supply of electricity is cut off.

Western Electrician.
EVERY SATURDAY.
Vol. XVIII. CHICAGO, JUNE 13, 1896. No. 24

## The Franklin Statue at Lincoln Park, Chicago.

The city of Chicago is fortunate in the possession of a noble bronze statue of Benjamin Franklin, designed and executed by H. K. Parks, and presented to the people by Joseph Medill, editor of the *Chicago Tribune*. The ceremonies attending the unveiling of the monument on last Saturday afternoon were attractive and impressive, and were witnessed by several thousand citizens of Chicago. The day was perfect, and the beautiful North Side resort never appeared to better advantage. The programme included music by a band, the singing of national anthems by a quartette and the people, addresses by prominent citizens, Mr. Medill's presentation speech, an oration by H. D. Estabrook and an ode by John J. Flinn. The flag veil was withdrawn by René Bache, a lineal descendant of Dr. Franklin, assisted by 13 young girls in white, who placed flowers at the foot of the statue. It was a very pretty and impressive ceremony.

The statue as revealed to the throng appeared as represented in the accompanying pictures. Mr. Medill had requested the artist "to make his model represent Franklin addressing a company of scientists, explaining his theory of lightning and its identity of composition with electricity, and relating his experiments whereby he proved it—the figure to be draped in the fashion of the period and stand erect, with calm, benign countenance, the whole showing a strong, self-possessed man past middle life, but still robust of body and vigorous of mind. With these general directions the artist proceeded with his task." How well he executed his commission is shown by the picture, Fig. 1. The statue is declared to be one of the finest works that Mr. Parks has executed. It is an admirable likeness and the costume is faultlessly true to the time the philosopher-statesman lived. The figure is of heroic size, being nine feet six inches high, and gives the characteristic pose observable in the celebrated pictures of Franklin. The whole is eminently lifelike and simple. The trunk is supported mainly by the left leg, the right being thrust slightly forward. The left hand rests on the hip, while the right arm hangs carelessly by the side. The massive frame is well proportioned and is well set off by the costume, the knee breeches, the shoes with buckles, the long coat and the frills at the neck giving as accurate an impression of what the philosopher looked like in life as it is possible to convey. Two pictures were taken as a guide in the execution of the work—both pictures being by Duplessis, the great French artist. The first used was that in the Corcoran Gallery in Washington. Indeed it was intended to make the statue entirely from this picture, but when the face was made it was thought by Mr. Medill to be rather too austere and cynical and it was believed a more pleasing expression might be had. This was found in the picture in the Metropolitan Gallery in New York. After the model had practically been finished the head was therefore taken off and a new face was made from the Metropolitan Gallery picture. This gives an impression of massive thought and benignity. The kindly, but shrewd and calculating, nature of the man finds expression in the features, which, though not handsome, are pleasing from the character the artist has succeeded in imparting to them. The total height of the statue is 21 feet six inches. The granite pedestal rises 12 feet and is strictly classical in style. The base is 12 feet square, the principal portion being in a single piece and weighing 13 tons. Two steps lead to the base proper, which are cut in a single block of stone. This likewise weighs 13 tons. The total weight of the pedestal is 46 tons. The pedestal is cut into five pieces, all of the best of the Barre granite. The statue itself is of bronze and is a perfect cast. The entire work cost $20,000 and represents a year's work by the sculptor. Every effort has been made to have the statue a work of art worthy of the city. The most exhaustive study was made both for the face and figure and for the costume, and the donor of the statue and the artist were in almost constant communication touching the details.

FIG. 1. THE FRANKLIN STATUE AT LINCOLN PARK, CHICAGO.

In the course of his address, which, by the way, was in his best strong and forceful style, Mr. Medill said that the monument was intended for the examination of the people of the great city of Chicago and the strangers who visit it, and especially as a reminder to the youths of the rising generation that the statue portrays the lineaments of one of the three greatest men the republic has ever produced, and that thus their curiosity might be stimulated to read and learn more about the patriotic and useful career of this remarkable American. Closing this admirable review of the great philosopher's life and work, the veteran editor said:

> Franklin's accomplishments may be thus summarized: First, he was a printer in all its branches, a past-master of the craft; then a publisher, editor, author, business man, inventor, legislator, electrician, scientist, political economist, diplomatist, statesman, philosopher and philanthropist.
>
> Some men were superior to Franklin in a particular specialty, and others may have been his equal in two or three things, but no man known to history ever equaled him in all the things in which he was great. Think over the many matters Franklin excelled in and then search for his peer in all or half of them. You will discover that he was more nearly a universal genius than any man of ancient or modern times. He possessed a brain that seemed to grasp and comprehend every subject of human thought. It is hard to name any of greater deductive powers. In that process of reasoning by which we arrive at the necessary consequence, starting from a premise, who was superior to Franklin unless it was Bacon? Who was more persuasive in his argument unless it was Webster? He discovered hidden things by deduction and proved them afterwards by experiment. He seemed to be endowed with intuitional insight in his investigations, and his reasonings were almost as conclusive as mathematics. He left a wonderful impression on the minds of his generation. But among all his preëminences he was most remarkable for his sympathies for poor, unfortunate, suffering humanity.

The picture, Fig. 2, shown on page 290 is a reproduction of a photograph taken during the exercises, from a point directly opposite that from which the picture on this page was made. At the left in the cut is shown the speaker's stand, erected for the occasion. At the time of the exposure Mr. Estabrook was delivering his oration. A partial view of the stands on which seats for invited guests were provided is also shown. Among those in attendance were many prominent electrical men, city officials, newspaper men and publishers, and a large representation of printers.

## Electrical Equipment of the New National Library Building in Washington.

By George H. Draper.

The new National Library at Washington, D. C.—that magnificent building now in course of completion, and which will cost $6,500,000—has been partially opened to the public, but the writer recently had an opportunity to visit some portions of it not usually accessible. The beauties of its architecture, elegance of the interior frescoing, etc., have been described, and it will now be of interest to the readers of the Western Electrician to learn something of the electrical installation, together with some observations on the boiler plant and other mechanical apparatus in the building.

It will be well to mention at the outset that the entire construction, both exterior and interior, in every detail, was under the direct supervision of the late Gen. Thomas Lincoln Casey, U. S. A., and since his decease under Bernard R. Green, who was selected by Congress to fill the vacancy.

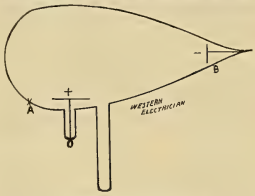
The library building proper covers nearly four acres of ground, is three stories high, with a large dome in the center. There are many rooms and book alcoves, an immense rotunda and large halls to be lighted, and it is estimated that it will take 6,090 incandescent lamps of 16 candle power to give the proper illumination. The chandelier and side-bracket arrangement is followed in lighting the rooms and alcoves, and in each alcove is also one or two pendant lamps for the purpose of easily finding books. In the corridors and rotunda or reading room, however, the lighting is somewhat more elaborate, the corridors being fitted out with shapely ground glass balls, while the rotunda is lighted almost entirely by diffused light. Except in the places where brackets are used, incandescent lamps are placed on top of the large pilasters and on cornices, and the light is reflected from the gold and white ceiling into the body of the hall below. Incandescent lamps will be used throughout.

While the electric plant is not entirely finished, there is enough in view to give one a general idea of the whole. Bids on the electric plant were made in detail, as was done in all other work, and the engines, dynamos, appliances and other material were furnished by the lowest bidders whose apparatus came within specifications. Good material has been secured and intelligent engineering skill is shown.

In the northeast basement of the building a large space has been set aside for the engine and dynamo room. It is 90 feet long by 28 feet wide and 20 feet high; it is excellently ventilated, and with its complement of necessary conveniences will be a very fine room of its character. The boiler house is an underground structure of brick and dressed granite, 125 feet long by 35 feet wide and 25 feet high. It has a heavy glass roof raised about four feet above the ground surface, and is located about 75 feet east of the center of the library building proper. In connection with it is a large stack 90 feet in height by 12 feet square at its base, which is also made of dressed granite.

The engine and dynamo room is well equipped. The plant is composed of four generating sets, three of which consist of simple automatic horizontal Ball engines of 150 horse power each, directly connected to three 125 volt 100 kilowatt Siemens & Halske dynamos, and one 35 horse power simple automatic horizontal Ball engine directly connected to a 125 volt 25 kilowatt General Electric generator of the six pole iron-clad armature type. The large sets run at 230 revolutions per minute and the engines have 16-inch cylinders and 16-inch stroke. The small set operates at 300 revolutions per minute, and has an engine cylinder of 8½ inches with a 10-inch stroke. The generating sets are located side by side, the dynamos being nearer the lightest side of the room, and about 15 feet apart. The small set, which will be used most for the day load, comes first as one enters the room. At the farther end of the room and occupying a very prominent position, will be located a handsome switchboard. It is to be of white marble, and will be one of the most attractive features of the plant when completed. It comprises generator panels, 15 circuit panels and one panel for power connections. Each machine has an ammeter and voltmeter, and one 4,000 ampere ammeter measures the total output of the plant. The booster system of regulation is to be used, and the apparatus for this purpose is located in the rear of the switchboard. All the instruments used for test and measuring have been supplied by the Weston Electrical Instrument company of Newark, N. J.

The entire building is wired on the two-wire system, and, as stated previously, 6,000 incandescent lamps of 16 candle power each are provided for. At full load a drop of three volts is expected. Simplex wire has been used throughout, and the Simplex Electrical company has already furnished about 25 miles of wire, all told. This wire has all been placed in iron-armored conduits furnished by the Interior Conduit & Insulation company, and, except that in the cellar of the building, is all concealed work. There are 16 single-throw double-pole circuit switches and 16 sets of feeders, with an entire cross-section of 6,300,000 circular mils, running to the several centers of distribution on the first floor, and from there




CROOKES TUBE PHENOMENA.

to the distribution boxes about the building. Molding and insulators have been used very sparingly, and only in those instances where this practice could not well be avoided. The mains and feeders are so arranged as to be used on one or all the machines at any time, and the lights throughout the building are under the control of the chief electrician.

On the east side of the boiler house, and running its entire length, are located two batteries of boilers, each composed of four pairs of Bashaw & Stebbins' ordinary tubular shell boilers of 60 horse power each, making a total of 960 horse power, and they are so arranged as to be used singly or all or any number of them at any time, and any one boiler can be cut out for repairs, etc., without interfering with the others. The boiler plant has a compact and neat appearance, and is finished in brass. There is a space of about 16 feet between the boiler fronts and the side of the room, at which point are located the fireman's office, engineer's office, bath and wash room and toilet room. At the farther end are store rooms and an ash-lift. At the south end of the boiler room, and on the upper ground surface, is a coal weigher's office, and diametrically opposite in a room similarly constructed for symmetry in appearance is housed the ash-lift. Coal is delivered to the boiler room by wheel barrows from a store-room, which in turn is replenished by means of surface manholes in the driveway.

Electricity is used in the library for power as well as lighting. A large tunnel has been constructed from the present Congressional Library, in the United States capitol building, through the capitol and library grounds to a point directly under the center of the Library building. This tunnel has a system of cable cars, which are operated by a five horse power electric motor, for the purpose of transporting books back and forth to Congress.

There are nine elevators in the building, used for freight, passengers and books, the power for which is hydraulic. Steam is generated at a pressure of 80 pounds, and, after going through a perfect system of steam piping, passes through a Hines separator and enters the engines. It is afterward exhausted through a feed-water heater, and the waste product is used in heating the building. There is nearly 75 miles of steam, water and other piping in the building, 20 miles of which is used in connection with the electrical wiring. Although electricity is used for illumination, it was thought best to install a few gas pipes.

As near as can be ascertained, the following is a list of the kinds of apparatus and materials used: Weston instruments, Ball engines, Siemens & Halske and General Electric dynamos, Stokes & Parish elevators, Bartlett & Hayward company's heating coils, Bashaw & Stebbins boilers and tanks, Davidson & Co.'s feed pumps, Simplex wire. The other electric material was furnished by many companies. Jenkins valves are used on the steam piping, Crane valves on the hot water and Chapman valves on the cold water piping.

## Crookes Tube Phenomena.

By Joseph F. Smith.

In the course of experiments at the Northern Indiana Normal School with a Crookes tube of the form shown in the drawing, I find that the tube improves with use and the quantity of gas in the tube gradually becomes less and less. Also, as the tube becomes more effective, less heat is produced. I have observed that in an active tube very little heat is produced, the energy of the current being directly transformed into X-rays.

With a tube of the style here shown I have been able

FIG. 2. THE FRANKLIN STATUE AT LINCOLN PARK, CHICAGO.—THE CEREMONY OF UNVEILING.

to see through the body below the ribs, and a piece of metal placed in an International Dictionary could be plainly seen.

One tube of the style here described, as it improved in efficiency, would occasionally produce a brilliant flash of fluorescence back of the anode, and the discharge seemed to take place backward from the anode and around it against the glass. Spots on the glass would fluoresce for five minutes a beautiful golden yellow after the current was turned off. Occasionally during the flashes brush discharges could be seen on the wire outside the tube back of the anode. Finally, while the tube was working nicely and objects were being examined with the fluorescope four inches from the tube, a spark

passed through the tube at *A*, destroying it. I cannot account for the spark passing through at that place unless it was because of a deposit of carbon on the outside from a flame used to heat the tube in getting it started. I am disposed to account for it in that way.

## Copper Gaskets at the Electrical Exposition.

Among the exhibits which attracted the attention of engineers at the booth of the United States Mineral Wool company at the late New York electrical exposition were the corrugated copper gaskets which have lately been widely adopted by engineers of power and electric plants where high pressure is used and a permanent steam joint becomes an important factor. This article is manufactured by the company named, whose headquarters are at 2 Cortlandt street, New York. This company also showed some samples of rock wool pipe covering, which, at a recent test made by the Pennsylvania State College, showed that it ranked among the best coverings on the market. It also incidentally illustrated the use of its mineral wool for filling in houses, railroad passenger cars, etc., to prevent the transmission of heat, cold or sound. Henry Franz had charge of the exhibit. Samples of the gaskets are sent free on application.

## Safety Wire at the Exposition.

One of the exhibits that made a lasting impression on visitors to the electrical exposition was that of the Safety Insulated Wire & Cable company, herewith illustrated. This display was described by an advertising expert in the WESTERN ELECTRICIAN of May 16th and was pronounced one of the most attractive and original in the entire exhibition. It is worthy of mention that the company is already feeling the result of this display, the orders received from persons attracted by the unique booth at the exposition being the best testimonial of the effect produced by original methods in advertising.

## Single-phase Self-starting Synchronous Motors.[1]

By F. H. LEONARD, JR.

Every central station manager who operates an alternating plant has to grapple with the question of power distribution. Applications for power service come in from every direction, and in many cases, properly worked up, would make a more remunerative business than that of furnishing current for lighting purposes. It is, perhaps, unnecessary to point out that the bulk of the lighting service averages but a few hours per day, whereas the motor service covers a much longer period, with a corresponding reduction in cost of the current output. The difference is so great that many stations are furnishing current for motor service at 50 per cent. of the price for lighting service, and, even then, figure that the motor business is the more profitable.

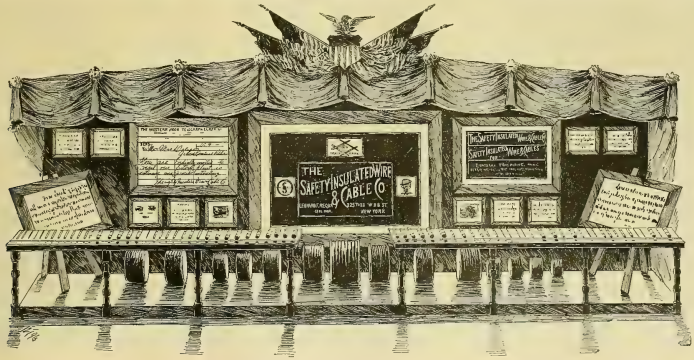
To secure this business and meet the demand for power service, many of the alternating stations have installed special 500 volt direct current generators and erected additional lines; but such a system is limited by the expense of such extension, necessarily paralleling other lines already constructed for lighting service. Under such conditions a remunerative piece of business is often refused on account of the first cost of the extension necessary to reach the customer.

The many advantages of the single phase alternating current system have led to its adoption in the great majority of the central lighting stations of the United States, notwithstanding the objections that (aside from a few inefficient fan motors of a fraction of a horse power) no motors practical for general power distribution were obtainable for use on this system. This objection, however, no longer obtains, as there are alternating current motors now made to operate on the single-phase circuits for ordinary lighting transformers without the use of special starting devices, condensers or connections, which not only equal the best direct-current motors in commercial efficiency, but are superior to them in point of regulation, reliability and freedom from burn-outs. With such a motor, which can also be used as a rotary transformer, the single-phase alternating system has every advantage of the low-tension direct current system, beside which it is much superior in simplicity, flexibility and adaptability for long-distance distribution. To-day arc and incandescent light, heat and power are distributed from the alternating system at a distance of a fraction of a mile, or at 50 miles or more, controlled, regulated and metered with equal facility and perfect satisfaction to the customer.

COPPER GASKETS AT THE ELECTRICAL EXPOSITION.

The single-phase alternating current motor has been to the electrician like the panacea of the alchemist, the cause of almost endless thought and experiments; but the solution of the problem was a most simple one and rests on two well-known principles. Attempts have been made to use induction motors on the single-phase circuits, but it is difficult to stop them, and usually very cumbersome and expensive arrangements have been devised which give but small starting torque. Besides this, to make them at all efficient and keep the power factor within reasonable limits, a very small clearance or air gap (often as little as one-quarter millimeter or one-hundredth of an inch) must be allowed between fields and armature, so that the slightest mechanical wear or vibration causes trouble. Even under the most favorable conditions it is impossible to construct an induction motor so as to avoid a very considerable lagging or so-called "wattless current." In such motors the power factor, which is the ratio of the real to the apparent energy, varies from 20 to 80 per cent. That is to say, if the motor has a power factor of 50 per cent. there must be double the current furnished that is actually required to do the work, and while half the current is wattless, yet it uses up capacity in generator, transformer and line wire, with energy consumption due to $C^2R$ losses in each, and in long-distance transmission the impedance (which is the only drop plus that due to the induction of the line, and which varies with the current and frequency) cuts such a figure as to make the expense for copper large in order to keep the working electromotive force within proper limits.

Pacinotti's discovery of the reversibility of a dynamo applies to alternating current machines as well as direct, except that the alternating current generators, when used as motors, must be brought to synchronous speed before it will fall in step with the generator, and further, must have its field excited with direct current usually from a separate source. It will then operate as a motor, and is the most satisfactory motor that can be produced when contant speed is required. Its efficiency is the highest; quite as high as that of direct current motors of equal capacity, while the regulation is perfect. So long as the generator with which such motor is connected runs at a uniform speed, the motor must run at a proportional speed, dependent on the ratio of the poles to the alternations; every impulse of the generator advancing the armature of the motor one pole. The motor cannot change its speed any more than if it were mechanically geared to the generator, unless it is overloaded to a point where it is impossible to carry the load, which point is usually about 50 per cent. in excess of the normal capacity of the motor. This is accomplished without the introduction of any lag or power factor, the load being practically non-inductive—like a load




SAFETY WIRE AT THE EXPOSITION.

1. Read before the National Electric Light association, New York, May 5, 1896.

of incandescent lamps—provided the proper excitation is maintained. Furthermore, by over-excitation the synchronous motor may be made to perform the office of a condenser and compensate for lag or inductive load, and can be carried so far as to induce a negative lag or lead, at the same time raising the electromotive force of the line.

The drawback to the single-phase synchronous motor has heretofore been that it could not be started without some other source of power, and would not carry its load up to speed. Motors are now made in which this is entirely overcome. They start up under load, and can be specially wound to give much greater torque in starting than when running in synchronism.

This brings us back to the two simple, well-known principles before referred to, which are combined in this

CLONBROCK STEAM BOILER COMPANY. THOMAS F. MORRIN, PRESIDENT.

motor—the principle of the ordinary alternating current synchronous motor with that of the direct current motor or generator. The armature has two distinct windings, one, a distributed winding connected to a commutator, similar to that of a direct-current motor or dynamo, which in this motor is used for starting and afterward for exciting the field. The other winding is of the shuttle type, wound so as to concentrate distinct and regularly alternating poles in the armature, and performs the regular work of rotating the motor armature, advancing it from one pole to the next with each impulse of the generator.

An ordinary double-throw switch on top of the motor is used in starting, there being no resistance or other complicated device, as the self-induction of the windings is sufficient to choke back any abnormal flow of current. In starting, the switch handle is depressed so that the double-throw switch, which then changes the complexion so that the leads from the transformer are cut off from the commutator and connected to the collector rings and concentrated armature windings, while, at the same instant, the commutator brushes are connected to the shunt field windings, magnetizing the field with direct current; the only office of the commutator after the motor is started and up to speed being to supply the small direct current necessary to magnetize the field.

In starting without load the motors will run up to synchronous speed in from five to 15 seconds, depending upon size, windings, etc., and, when loaded, in from 15 to 30 seconds, taking about the same current in either case, the time factor making the difference in the power consumed, the current taken under these conditions amounting to from 25 to 50 per cent. in excess of what the motor will require when running in synchronism. But when only required to start itself or light countershafting, this current may be greatly reduced by special windings.

The direct current winding delivers a perfectly smooth current, and is not at all pulsating in character. In circuit with the field winding is a rheostat to control the extent of field excitation. This rheostat is located in a recess in the base of the motor, the handle for its regulation being accessible through the oval opening at the commutator end pedestal. The motor, starting switch and field rheostat are in one piece, making a most simple and compact combination. All that is necessary to install the motor is to connect the secondary wiring of the transformer to the two binding posts on the motor, and it is ready for operation.

The general design of the machine is substantial and symmetrical, with graceful curves sweeping from point to point, giving the motor a very pleasing appearance. Nothing has been spared in the design and construction of these motors to make them as perfect as possible, and the motors are evolved from a careful consideration of the two years practical operation of a synchronous motor, after which a thorough course of experiment was instituted and carefully tabulated to determine beyond a doubt the accuracy of the calculations for the new design. Careful attention has been given to every detail that would tend to make the motor neat in appearance and simple, so that the man without previous training into whose hands a motor usually falls would have no difficulty in its use.

The mechanical perfection of any piece of machinery is the all-important one, and in this motor has been given the full attention it deserves. The best engineering practice of the day has been followed, and where any departure has been made it has been to make the construction more rigid and capable of resisting overload and excessive strain. The bearings are of bronze, self-aligning and self-oiling; two small rings traveling in recesses in the boxes so that they can touch the top of the shaft, the rotation of which carries the rings around, lifting, as they turn, enough oil from the chamber below the bearings to keep the shaft abundantly lubricated. As the oil is used over and over again, a single filling furnishes lubrication for months; and as the oil gets low, the rattling of the rings serves as a warning that the oil should be replenished.

The field crown is of the multipolar type, with field of the field punchings to the top, concealed from view, however, by the perforated steel jacket, which is held in place by grooves in the cast-iron clamping rings, forming an ornamental finish and greatly increasing the radiating surface.

The binding posts for the motor are located at the center line of the switch. Any inside wireman who has connected incandescent lamps will have no difficulty in wiring and connecting one of these motors, as the work is precisely the same as for a two-wire lighting service. The primary wires are connected through a primary fuse box to the transformer. The secondaries of the transformer, which are perfectly insulated from the high-tension primaries, carry the low-tension currents which are induced in the transformer through the fuse box, which is provided as an extra safeguard against the

CLONBROCK STEAM BOILER COMPANY.—STEPHEN V. MORRIN, VICE-PRESIDENT AND GENERAL MANAGER.

accidental flow of any dangerous current; and from there to the double-pole knife switch, which is used to turn the current on and off from the motor. From this switch two wires connect to the binding posts of the motor. There is no multiplicity of wires or special connections for starting box to perplex a person.

The purposes to which these motors are applicable are almost without end; ranging from commercial use in labor-saving devices, such as printing presses, type-setting machines, lathes and machine tools, elevators, laundry and sewing machines, pumps, ice cream freezers, church organs, coffee mills, sausage machines, etc., down to twirling ceiling fans in a restaurant, where you can enjoy a comfortable meal in the heated months, or to driving a "merry-go-round" on which the children, and often the older ones, delight to ride on a holiday in the public parks or at the seashore.

FIG. 1 CLONBROCK STEAM BOILER COMPANY.—THE FACTORY AS IT APPEARS TO-DAY.

lead wires which conduct the alternating current from the transformers are connected through the switch blades to the contacts which lead the current first to one of the commutator brushes, thence through the distributed armature windings and out through the opposite brushes to a coarse wire winding on the field poles and back again to the switch contacts and binding posts, these connections being identical with those of a direct current series motor. As soon as the current is turned on, the motor commences to rotate at a constantly accelerating speed until synchronism is reached, which is indicated by the lighting of a lamp located on the switch at a dull red. This is the signal for the reversal of the cores pointing inwardly: the magnetic circuit is composed of sectional sheet-iron punchings, each section including two poles, stacked so as to break joints. These punchings interlock and are clamped between two cast-iron rings with bolts passing through from side to side, which serve to clamp the whole together solidly, at the same time holding each punching in its proper place and tying them like links in an endless chain. The bottoms of the cast-iron rings are milled to fit the base of the motor, to which they are firmly bolted.

On top of the field crown is placed a starting switch, and all the electrical connections from fields, commutator and collector brushes are brought around the outside

As this motor runs at a constant speed, it has been necessary to devise several special arrangements to accomplish what might be done by variable speed motor. Motors are made for blowing church organs, in connection with which it has usually been customary to provide complicated automatic speed regulating devices. With this motor no attempt has been made to vary the speed. The organist closes his circuit and starts his motor by means of a pedal. A blower, driven by the motor, fills the bellows and maintains a constant pressure, usually about four ounces per square inch. If no air is used, the blower spills the wind out of its fan and requires only enough power to overcome the friction and maintain

the pressure. As fast as the air is used the blower takes a corresponding amount of power, the motor absorbing the current accordingly.

An arrangement for elevator service which is extremely simple has been devised. The constant speed alternating motor, cable drum and gearing are all mounted on a single base casting, in which the respective parts are bolted. There is a pinion on the shaft of the motor which engages two bevel gears, each mounted on a sleeve, which also carries one part of a friction clutch, the two sleeves rotating in opposite directions, and the whole being supported by and turning freely on the worm shaft which engages the worm-wheel that turns the cable drum. The other part of each clutch is keyed to the worm shaft. The controller wheel is mounted on an extension which is cast on the case that entirely encloses the bevel gears and pinion, permitting them to run constantly in oil. This controller wheel is connected to the controller cables or hand ropes which serve to operate the elevator. A pull on the hand rope turns the controller wheel, rotating it through an arc of 60 degrees. This rotation serves, first, to release the brake on the worm shaft, by means of the adjustable link and lever, by depressing the roller which travels over the cam in the controller wheel; at the same time, one shipper fork is moved by the con-

[Continued on page 295]

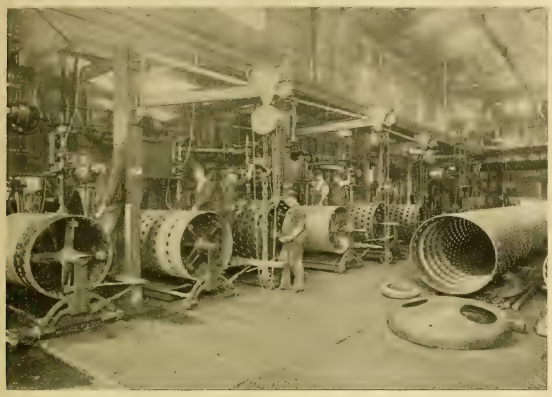


FIG 2. CLONBROCK STEAM BOILER COMPANY.—SHELL DRILLING DEPARTMENT.

## Clonbrock Steam Boiler Company.

In the manufacture of such a staple and widely used article as the steam boiler, success is usually attained only after years of laborious effort and the gradually acquired reputation of a long period of time. But no rule is without its exception, and in the boiler industry this exception seems to be the remarkable growth and expansion of the Clonbrock Steam Boiler company of Brooklyn, which was organized less than eight years ago, the exact date being December 12, 1888. At that time a small frame building near the corner of Smith and Lorraine streets sufficed for the needs of the business; now the ample works represented in Fig. 1 are none too large.

The steam boiler which this concern manufactures is known as the "Morrin Climax," and is the invention of President T. F. Morrin of this company, whose portrait accompanies this article. It is the result of a careful investigation into the subject of steam engineering during 27 years of service as chief engineer for the P. Lorillard Tobacco company of Jersey City, which is known throughout the country. It is said, indeed, that this concern has been able to hold its position against the tobacco trust by reason of the special machinery and mechanical appliances designed by Mr. Morrin, whereby it has been able to produce its goods much more cheaply than its competitors. Mr. Morrin entered the employment of the P. Lorillard Tobacco company at an early age. He remodeled the mechanical construction of the works; but of all the saving which he was able to perform for this company, it is said that the greatest success has been seen in economy of consumption of fuel and production of steam by the Morrin boilers.

The works of the Clonbrock Steam Boiler company (Fig. 1) cover nearly four acres of ground, and, when working to full capacity, employ about 250 hands, having a day and night shift of men. No expense has been spared in equipping this plant with the latest machine tools and the varied apparatus necessary to produce a boiler of this type in the highest state of efficiency. A hydraulic press of 70 tons weight, with a capacity of 2,500 pounds to the square inch, which is used for stamping purposes, enables the company to fashion heavy masses of metal. A table punch, which is claimed to be one of the largest in the world of its kind, has a capacity of 100 holes a minute, and is used in punching work used in connection with water towers and large smokestacks. Conspicuous, also, are the power bending rolls of the largest make; these machines can bend iron one inch thick by 12 feet wide.

In the shell drilling department (Fig 2), as represented in the picture, are seen boiler shells in various processes of construction. Post and traveling cranes and other apparatus for handling heavy weights show that arrangement is made for the quick handling of stock. Fig. 3 gives a view in the pipe bending department. Here are located some of the experts of the works, as all of the boiler tubes are received in stated lengths and are then filled with sand, heated in a retort, and then shaped around a cast-iron form, so that all tubes are exactly alike and interchangeable. Here is also located an auxiliary stock room. The riveting and forging departments are a very busy portion of the works. It is here that all riveting is done by hand. No holes requiring rivets, in the construction of these boilers, are allowed to be punched, but are all made by a twist drill, thus insuring accuracy and in no case injuring the strength of the metal; and the fact that the company claims that it never had a failure in a boiler shell to stand the prescribed test of 800 pounds cold water pressure speaks volumes for the careful management of this department. A large machine room, where all machine finishing is done, with the necessary tool work upon the fittings for the small parts and boiler trimmings, is furnished with modern tools and all the necessary adjuncts for high-class work.

A smokestack 16 feet in diameter and 175 feet long, which will weigh 77 tons, is now being constructed by this company for the Municipal Electric Light company of Brooklyn, and it is said to be one of the largest ever manufactured.

S. V. Morrin, whose portrait is given, was elected vice-president and general manager of the Clonbrock Steam Boiler company in January, and there are but few young men of his age holding such a responsible position; but he has won his spurs by hard work and practical knowledge gained from beginning as a boy in the yard, and working up until he was offered his present position.

Col. A. E. Jones has charge of the sales department, and is a gentleman widely known in the boiler and iron interests of the country, being a mechanical engineer of high standing. He brought with him a long practical experience by his connection with the West Bergen and also the Newark Steel Works of Newark, N. J. He reports that he is perfecting arrangements to locate agents in the leading cities of the country during the coming year. Secretary F. A. Mason is in charge of the financial and accounting departments. His reputation as an expert accountant eminently fits him to occupy this responsible position. He was previously connected for several years with the Edison Electric company and the Interior Conduit & Insulation company in positions of responsibility. Superintendent J. D. Alexander has charge of the works, and all mechanical construction is under his supervision. As a master boilermaker, he is known as being one of the best posted in this line of business. A large corps of men under George Baum, who has charge of the drafting and designing departments, is kept busy in furnishing the many estimates and plans which are required.

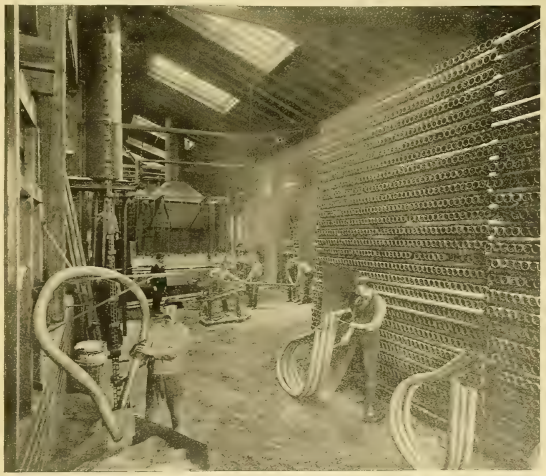


FIG 3 CLONBROCK STEAM BOILER COMPANY.—TUBE BENDING DEPARTMENT

# Western Electrician

EVERY SATURDAY.

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**SUBSCRIPTION,** in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

**ADVERTISING.**—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

| Issue. | Number of Advertising Pages. | Total Number of Pages. | Square Inches of Paid Advertising Matter. |
|---|---|---|---|
| March 3, 1894 | 40 | 56 | 4,145 |
| February 23, 1895 | 52 | 68 | 5,593 |
| May 9, 1896 | 72 | 88 | 7,576 |

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

FOREIGN inventors are beginning to realize the advantage to be derived from securing the adoption of their ideas by American manufacturers. One much talked of improvement which has been patented at Washington by Carl Pollak is a "current straightening commutator" which was brought to the attention of the public through the communication of F. H. Mason a United States consul at Frankfort-on-the-Main, and published in the WESTERN ELECTRICIAN November 16, 1895. The device was illustrated in detail, as well as the application which attracted Mr. Mason's attention, in this journal January 18th. Much interest has been manifested in this device and one American inventor at least, Adolph Hamacek of Sturgeon Bay, Wis., contests Mr. Pollak's claim to the invention.

MANY of our contemporaries have adopted features introduced by this journal, and some of them have, at times, appropriated and reproduced articles and illustrations from these columns without the slightest credit. The latest case that has come to our notice is that of an eastern contemporary, in which 10 half-tone portraits reproduced from the WESTERN ELECTRICIAN formed the leading feature of one issue. There is some gratification in finding such unmistakable evidence that the value of one's labor and judgment is appreciated by others, but this recognition would be much more acceptable if it were accompanied by proper acknowledgment. As it is, we cannot commend our contemporary's "enterprise." Its policy is reprehensible, and unless a radical change is made it will earn for itself the title of the *Piratical Age*.

THROUGHOUT the East, especially in New York state, where there are numerous cities and villages at short distances, the development of the trolley has become phenomenal. It is estimated that there are 1,100 miles of electric railway in the state of New York, and it is anticipated that within the next five years one will be able to go from New York to Buffalo by the trolley car along the lines which will interlace the cities and villages upon the route. It is not predicted that the trolley will displace steam as a general means of rapid travel and traffic. Its utility may be confined to comparatively short distances, but within its limitations its expansion must be something enormous. The cheapness of construction and equipment, the ease and enjoyment of locomotion afforded, the fair returns upon capital invested combine in assuring for the system the most splendid development and in guaranteeing its permanence. This is the view of an experienced writer in Western New York who has given the subject careful consideration. It must be confessed that the trolley has earned all the good things that have been said about it.

MAYOR PINGREE has admitted that the cost of street lighting in Detroit exceeds $60 or $65 per lamp per year under the present arrangement, and furthermore he admits that he does not know the actual cost of street lighting in his bailiwick. The mayor "thinks" that there will be a saving effected for the taxpayers by the present plan of having the city operate its own street lighting plant, but the opinion is not supported by any good reasons that would influence a business man to make a similar change, and the mayor's opinion is not one whit more valuable than that of hundreds and thousands of other citizens of Detroit. Some of these think the mayor is right in his views, others entertain different opinions There have been no reliable figures presented that bear out the mayor's statement, and the experience of other municipalities goes to prove that the mayor's theory is not at all practicable. But the people of Detroit will have to find this out for themselves. What the electrical fraternity is mostly interested in at the present time is preventing other communities following the example of Detroit, under the mistaken notion that that municipality is saving money by operating its own lighting plant.

DURING the last few weeks there has been a strong movement on foot in Milwaukee to form a new street railway system, the idea being to have the people at large furnish part of the capital and have the city lend its indorsement to the scheme for the rest of the funds needed, the project eventually to come under control of the city. The people of Milwaukee have strongly and persistently battled the street railway and lighting interests, and more than once there has been apparent danger of the city engaging in competing enterprises. These movements have been helped along by the attitude of the managers of the corporation now controlling the lighting and transportation business of the city. The company is cordially detested by the laboring men of the city, and as the business of the community has been seriously affected by the labor troubles, the merchants are dissatisfied and impatient for a settlement. The merits of the original controversy out of which the strike developed have long since been dismissed from consideration. The company maintains that it is fighting for a principle; the men contend that they are doing a public service in resisting the oppressive measures of the corporation; all efforts to effect a compromise have failed; the company is operating its cars at great loss; the men are fast approaching the point when they will become public charges unless a settlement is reached, and the business of the entire community is unsettled by reason of this difference. It is not to be wondered, then, that there is much encouragement for the plan of establishing a competing system under the control of the city. It is intimated that some of the men advocating this plan are not actuated by the highest motives, but so far as public interests are concerned the present management of the lighting and street railway business of Milwaukee cannot consistently offer any criticism.

THE stock market was affected seriously recently by the announcement in the daily papers that a new electric manufacturing combination had been formed to fight the General Electric and Westinghouse companies. New York, Philadelphia, Boston and Cleveland capitalists were reported to be interested in the concern, the names mentioned including those of Roswell P. Flower, Anthony N. Brady, J. W. Hinckley, Belmont Dallas Sanders, William Rotch, Parker C. Chandler, Frank Billings and Jacob B. Perkins. Later it transpired that the announcement was based upon the fact that the Walker company had taken steps to extend its facilities, and the announcement was made that it "had just secured the contract for furnishing an electric plant for the New York and Brooklyn bridge, also the generators for two railroads in Chicago, for some of the equipment for the elevated railway there, and for roads in Kansas City and Detroit." One result of this announcement should be to convince those who are constantly talking about a trust, of the absurdity of any attempt at a consolidation to control the electrical market. Such a combination even as that of the General Electric and Westinghouse interests is seriously affected by every story that is sent out about organized opposition. In view of these facts it seems ridiculous to seriously consider the formation of a practical monopoly in the electrical field.

CHICAGO is indebted to one of its distinguished citizens, the Hon. Joseph Medill, for a memorial of Dr. Franklin—a noble production of art worthy the subject, the donor and the place in which it stands. The object of the memorial is best explained in the words of the gentleman to whose liberality and patriotism the city of Chicago is indebted: "I have erected this statue to Franklin not to glorify myself, not even to glorify Franklin—that were indeed superfluous; I have erected it rather to the glory of American manhood. I wish it to stand forever as a reminder to the young men of my country to study the life of this simple, sturdy, stalwart character, that their own lives may profit by it." No better location could have been selected than Lincoln Park—the most popular pleasure ground of the people of Chicago, which also contains memorials of those illustrious Americans, Lincoln and Grant. Up to the time of the unveiling of the Chicago monument there were only two bronze statues of Franklin open to public view in the United States—one in Boston, the other in New York. One is now being constructed in Philadelphia, as has been noted in this journal. On one of the streets of Washington there stands a marble statue. There are three original paintings of Franklin in this country by the famous French artist Duplessis, painted on orders of his admirers during his diplomatic residence in Paris. One hangs in the Corcoran Gallery of Art in Washington, the second in the Metropolitan Museum of Art in New York, and the third in Boston. The statue unveiled at Lincoln Park last Saturday is the only memorial of the great American philosopher in the West. The electrical fraternity is gratified by this splendid testimonial in honor of the memory and achievements of the first great American electrician

## Single-phase Self-starting Synchronous Motors.

[*Continued from page 293.*]

necting rod at its upper end, which is pivoted near the upper rim of the controller wheel, far enough to cause one of the clutches to engage its other part on the sleeve attachement to the bevel gear, so as to drive the worm shaft and rotate the cable drum. At the same time the connecting rod attachment to the shipper fork opposite moves across the center of the controller wheel without producing more than enough movement to take up the lost motion in the clutch parts to which it is attached. Pulling the hand rope in the opposite direction brings the parts back to their original position, disengages the clutch, and sets the brake on the worm shaft. Pulling still farther in this direction, the opposite connecting rod travels so as to move the shipper forks and engages its clutch, turning the hoisting drum in the opposite direction, while the first mentioned connecting rod moves across the center without causing any appreciable movement of the shipper fork.

The motor runs continuously in one direction during working hours, and there is no heavy rush of current in starting, as with a direct current series motor, with its tendency to drop the brilliancy of the incandescent lights on the same circuit. Neither is there any necessity for complicated automatic starting rheostats, safety devices and multiplicity of connections; two wires only connect the secondary of the transformer which furnishes the alternating current to the motor. There are many classes of work in connection with which perfect uniformity of speed is of vital importance. To such cases these motors are peculiarly adapted, as an overload of 50 per cent. may be instantly thrown on unto these motors and the next instant thrown off without changing the speed in the least; not even causing a variation of a fraction of a revolution

These motors are suited to any frequency in general use in this country, and are wound for from 140 to 60 complete periods per second, the speed being fixed by the frequency of the generator or circuit to which it is connected. It will no doubt be understood, however, that a motor wound for 140 periods or 16,800 alternations, under which conditions it would run at 1,400 revolutions per minute, would not be suited for use on a 60 period circuit or 7,200 alternations, where the motor would run at 600 revolutions per minute.

All sizes from one horse power to and including the 10 horse power are wound for 100 to 110 volts secondaries, though the larger sizes are designed for higher potentials, as 200 and 300 volts, and even for direct connection to primaries, where proper attendants are in charge, though this would not be safe in general practice, where the person dealing with the motor is not fully acquainted with what he is handling.

While this motor was designed for single-phase circuits, yet it is obvious that it will work quite as satisfactorily when connected to either leg of a two or three-phase circuit, and where such circuits are loaded with induction motors a few synchronous motors properly distributed and somewhat over-excited would serve to allay the pernicious effects of the inherent lag or idle current which goes with induction motors, at the same time raising the electromotive force at the extremities of the line, reducing the drop in the conductors and allowing the generators to do more work, inasmuch as they would not be required to deliver so large a wattless current.

This synchronous motor is also a good rotary transformer, and lends itself very conveniently for charging storage batteries and electrolytic work; the alternating current entering at collector rings, while direct currents are delivered from the commutator brushes. For laboratory work and as a piece of apparatus in colleges that teach electric engineering it is invaluable, for, besides the previously mentioned uses, it may be driven by direct currents as a series motor; further, it may be run at a constant speed as a direct current shunt motor, while from the collector rings alternating currents may be taken at any frequency, dependent upon the speed, which may be regulated by resistance in the field or armature circuits, or, belt driven, it may be used as a self-inciting alternator.

### Discussion.

MR. WAGNER: I should like to ask Mr. Leonard the effect of switching at the central station on the operation of the motor when running at full load. I have had such motors in operation myself, covering a period of three years, and I find that it is an almost insurmountable objection to the use of the synchronous motor, as the frequent switching found necessary to properly divide the load on alternating current generators causes the motors to fall out of step.

MR. LEONARD: What Mr. Wagner says is quite true. If a motor fully loaded has the current switched off, it will slow down to a point so much below synchronism that it is impossible to go on, unless the switch is reversed, so as to put it in the position of starting. In most stations where these motors have been used, the circuits on which the motors are run are not switched, except at hours when the motors are not in service, or it is done while the machines are in multiple, preventing the breaking of the circuit and the cutting off of the current.

MR. VAN TRUMP: I should like to ask Mr. Leonard if there is not a difficulty in operating these motors due to a difference in the curve; that is, in the wave line of the motor differing from the generator? I have operated synchronous motors to some extent, and I find there is considerable difficulty in getting any motor to work in this way, due to the difference in the character of the curve of the generator making a fluctuation.

MR. LEONARD: These motors are wound, as stated in the paper, with a concentrated winding; that is, what is known as the iron clad winding in alternating circuit phraseology, and while they operate with a greater taut, that is the ultimate point at which they will fall out of step, the utmost load they will carry with an iron-clad armature is about 15 per cent. 10 to 15 per cent greater with an iron-clad motor than with a smooth bore winding. Most of the single-phase alternators in general use now, however, have the iron-clad winding, and the only difference that would occur would be that the maximum taut, the limit of the load, would be a little lower with a smooth bore winding than with an iron-clad. The wave line makes no difference.

MR. FERGUSON: I wish to know if there is not a danger, in case that machine was started up on a light load, and the operator did not fix the switch in time, of allowing the machine to accelerate its speed to such an extent that it would go all to pieces?

MR. LEONARD: That would happen if it were allowed to be carried on to a sufficient extent. The instructions going with the motor direct that the switch should be reversed the moment the lamp on top of the switch is lighted directly in front of the man holding the handle. If he fails to do that, and there is no load on, the acceleration of speed might go on, as Mr. Ferguson suggests, to an extent sufficient to throw the armature winding out and damage the machine. We have had very few cases of that, however. The thing has occurred, and it might occur with a careless attendant, but if a man does it once, he never does it again.

MR. WAGNER: I should like to refer again for a moment to the question of central station switching. It is found necessary to divide the load between a great number of generators at the busiest times of the year, quite early in the afternoon, long before the motor load is taken off; in other words, at a time of the year when the day and night loads overlap, and it seems hardly possible, nowadays with switches to such times of the day—say after six o'clock—when the motors are generally not in operation. Mr. Leonard admits that the motor must stop if any such switching occurs at the station. His reference to stations where generators run multiple applies to plants which are very recently installed, or in process of installation. Until the last few months, I might say, there has been practically no place in the country were stations were operated in multiple. We are accustomed to a motor that will operate on existing stations and under existing methods, and it seems to be he fails to bring that point out very clearly how such stoppages of the motor service are to be prevented.

MR. LEONARD: In practice, we have not had very much objection on account of the fourteen mentioned by Mr. Wagner. Of course, if circuits are switched when the motor is loaded, and the phases are not exactly coincident in both generators, which is hardly likely to be the case, the motor will fall out of step, but it seems to me that it might easily be arranged so that dealers supplying the motive power could be handled in such a manner that it would be unnecessary to switch very much during the hours of the motor load. In the little experience that we have had we have found no great objection upon that point. In some cases it has been necessary to switch: for instance, a thundershower, or something of the kind coming up, and darkening everything suddenly, then it has been necessary to switch. But the standards are very recently established by which circuits the motors are on, and they endeavor in most cases to avoid switching the motor circuit. It is an easy matter, however, in case the motor is thrown out of step, by cutting off the current for a few seconds, to start the motor again. People are willing to put up with that slight objection, or adjust their conditions so as to avoid this difficulty. At least, that is what we have found.

MR. WAGNER: I wish to say that I do not make these criticisms as reflecting at all upon Mr. Leonard's motor, but merely from the fact that I have had motors of exactly the same type in operation for the last three years and have finally decided that I would have to give up work in that line, such objections seem to be unsurmountable in ordinary practice. I admit that I failed to solve the problem myself.

## Fiftieth Anniversary of the Telegraph in Belgium.

S. F. B. Morse, one of the best known electricial men in Chicago, often receives letters and verbal inquiries relating to his famous grandfather of the same name, who first put into practice the art of electric telegraphy. A late letter from Belgium shows that at the approaching celebration of the first half-century of telegraphic service in that country the name and fame of Morse will be appropriately honored. This interesting communication is from J. Banneux, the engineer-in-chief and director of the state telegraphs of Belgium, and is dated at Brussels May 20, 1896. Translated, it is as follows:

The administration of telegraphs of Belgium will celebrate on September 9th next the fiftieth anniversary of the establishment of telegraphic service in the country. On that occasion I would be pleased to exhibit to those familiar with his apparatus an authentic portrait of the illustrious American inventor, Morse.

Again, one of the noted painters of the day, charged by the government with the production of an historical composition to ornament the walls of the postal and telegraph stations in Brussels, has pictured Prof. Morse among his principal figures, and to this end he seeks to obtain as faithful a likeness as possible. We will therefore be very grateful to you if you can find it within your power to send us two good photographs of your illustrious grandfather, especially those which represent him in the last years of his life. [See WESTERN ELECTRICIAN, May 26, 1894, *Electrical World*, vol. xxvi, July 27, 1895.]

Understanding my object, that of honoring one of the fathers of the electric telegraph, I am persuaded that you will, if possible, accede to my request, at least in referring me to Professor Morse's son, whose address is unknown to me.

I beg to present to you, together with my thanks, the expression of my sentiments of the highest consideration for you.

## Violence in Milwaukee.

[From the Milwaukee correspondent of the WESTERN ELECTRICIAN.]

Much violence has recently marked the trouble growing out of the street railway strike, and the situation is very threatening. Cars have been fired upon from ambush and a conductor, a motorman and a passenger have been wounded. The company has called upon the sheriff for protection and has requested him to call upon the governor, which may result in calling out the militia, in case the force at the sheriff's command is not equal to the occasion.

Men who were stationed in a clump of bushes on the Howell avenue line, about half a mile south of the city limits, fired upon a car on Thursday evening. The car was coming into the city when a tree was found across the track. While they were trying to remove the obstruction, John E. Breen, the motorman, and Adolph Schwarz, the conductor, were wounded by shots fired from revolvers. Breen was shot through the kidneys and this morning [June 6th] his condition is such that there is little hope of his recovery. Schwarz received a bullet in his knee. It was a flesh wound merely and he has already been taken from the hospital to his home. It is stated the shooting was done by ten or twelve men who were seen running toward the city shortly afterward, and who, when asked about the shooting, by two men who had heard the fusillade and saw them running, replied that a lot of Pinkertons were in the woods and had been shooting at them. The police were promptly put to work upon the affair, and they have made nine or ten arrests, mostly upon suspicion.

At Walnut and Eighteenth streets last evening a Wauwatosa car was fired upon by men who stood in the shadow of a church. The shots were aimed at the motorman standing on the front platform of the car, but Hugh L. Thomas of Philadelphia, a passenger, was hit by one of the bullets in the left knee. He was standing on the platform with the motorman at the time. He was bound for Wauwatosa to spend the night with a friend. He says that when the car reached the corner of Walnut and Eighteenth streets a volley of shots rang out. He turned in a startled manner, saw two figures in the shadow on the east side of the street, saw the flash of pistols and suddenly felt a sharp pain in his knee. There were two at least in the party, he said, and they ran down the street after firing upon the car.

The company has experienced a great deal of difficulty at Silver City, a suburb west of the city, mobs assembling and stoning the cars. The attorneys of the company served formal notice last evening upon Sheriff Stanley that it was determined to operate its lines, that it demanded protection, and that if the sheriff could not cope with the disturbances with the force at his command, he must call upon the governor for assistance.

The company has offered a reward of $2,000 for evidence leading to the arrest and conviction of the men who fired upon Conductor Schwarz and Motorman Breen. The company has also made a present of $250 to each of the following named employes: Superintendent George Kuemmerlein, Superintendent of Construction A. W. Lyan, Assistant Superintendent T. E. Mitten, Chief Engineer W. C. Crawford, Chief Electrician O. M. Rau and Assistant Electrician W. C. Smith. Barn Foremen Louis Witt, Frederick Fredericks, J. Hayes, J. Rennie and J. Archbaugh received $70 each; Inspectors John Kelly, S. Wilson, P. Bell and Albert Liens $65 each and Claim Agent Richard Manhart $80. These were rewards for faithfulness and extra work during the strike proper.

The company has all the men it needs, and there is no longer any chance for the old men going back, except now and then, as vacancies occur. "No Help Wanted" is a sign that is displayed at the company's headquarters

Mr. Payne has made a detailed explanation of the offer of President Gompers of the American Federation of Labor and the counter proposition of the company.

"Mr. Gompers' proposition," said Mr. Payne, "was that the working day of 20 hours per car be divided into three parts, two of eight and one of four hours; that all car men in our service be employed on this plan and paid at 19 cents an hour, the men to take the long and short days by turns. The pay of all the car men would thus be reduced to $1.26⅔ a day." The proposition of the company, in return, was then given by Mr. Payne as follows: To continue the present force of 608 men at 19 cents an hour, day men to work 10½ hours and earn $1.99 a day, and the night men to average nine hours and earn $1.71; to re-employ immediately an additional number equal to one-third of 608, or 203 and guarantee to pay these men 19 cents and to give them not less than eight hours work a day; all of the old employes not provided for by this plan to be placed on the extra list and re-employed as rapidly as possible. Mr. Payne said that the plan suggested by the company would have involved the payment of at least $1.52 to 203 men, or $308.56 increase over the present expenses, to bring about the end of the unhappy condition of things at Milwaukee.

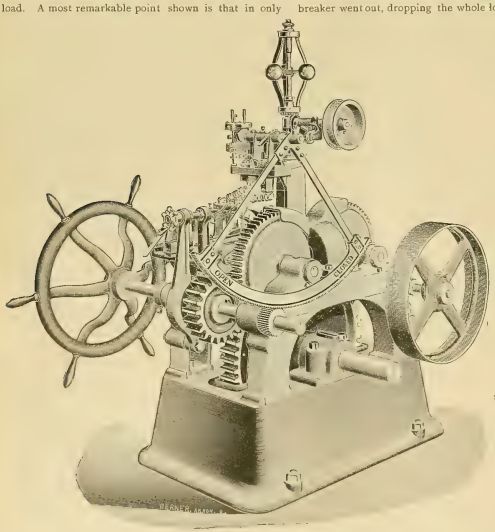
## Replogle's Relay Water-wheel Governor.

The machine herewith illustrated is the new relay water-wheel governor built by the Replogle Governor Works of Akron, O. It is well known that water-wheel regulation in electric railway work presents a difficult problem, so the details of a recent test of this governor on the water-driven electric plant of the Citizens' Street Railway company of Fishkill-on-Hudson are interesting and valuable.

The conditions were very severe. The time chosen was during a heavy snow storm, with fully three inches of new snow on the track, and the circuit-breakers went out 10 times during a 30 minutes test. This of course made instantaneous changes of from full load to no load. A most remarkable point shown is that in only one case did the speed rise to slightly exceed five per cent from normal. The normal voltage was 550 volts, but in no case did the voltage reach 600, and in only one case did it get below 500 volts. These are the extremes and were due only to instantaneous changes of full load, and the variations in speed were only momentary.

There are seven miles of road. The maximum grade in this road is 8½ per cent. There are two portions nearly one half mile long each that average about five per cent grade. There are some short curves and some of them are found on the heavy grades. The main line is giving a 20 minute service, and the suburban line an hourly service. At the time of the test four double motor cars were in operation, using from 30 to 50 horse power each. The power is furnished for this road by the Carroll Electric company, Matteawan, N. Y., from a pair of 48 inch Rodney-Hunt water-wheels, under about 15 feet head of water, and is conveyed by belts to a countershaft which in turn drives by belt a General Electric 100 kilowatt generator. The wheel can be supplemented by a Fishkill-Corliss engine, which is belted to the same countershaft as the water-wheel, but during this test the engine was disconnected, leaving all the power to be furnished by the wheel, making this a safe and reliable sample of results that can be secured under such conditions.

The readings began at 12:38 P. M. and continued for 30 minutes, until 1:08 P. M., when the papers were signed by the readers and committed to the hands of C. E. Hewitt, the electrician, who made the tabulations. The average or normal speed was 105 revolutions on the wheel shaft, and the average voltage was 550. There were 80 amperes of current, 540 volts pressure and 103 revolutions on water-wheel shaft at the end of the first minute. At the end of the second minute a chart shows no current, 546 volts and a speed of 104 revolutions of water-wheel shaft, and 20 seconds later there are 110 amperes used, and the voltage has dropped to 516. The reading 10 seconds later shows no current, 564 volts and 107 revolutions. Over one-half of the load dropped off in 10 seconds, and yet the speed went only two revolutions above normal. This is less than two per cent. increase of speed on a 55 per cent. decrease of load. At the end of the first 10 seconds in the sixth minute there was no current, the voltage was 552, and the speed 104, and 30 seconds later there was full load, 200 amperes, 540 volts, and a speed of 102 revolutions. The reading 10 seconds later was 70 amperes, 556 volts and 105 revolutions, showing that 65 per cent. of the load dropped off in 10 seconds, and yet the speed did not go above normal. At six minutes and 45 seconds the circuit-breaker went out, dropping the whole load instantly, yet five seconds latter the reading was no amperes, 530 volts and 107 revolutions. This is equal to the best engine work. The circuit breaker went out during the 2d and 3d minutes with practically no increase in the speed. At 26 minutes and 10 seconds the readings were 200 amperes, 520 volts, and speed 101. During the following 10 seconds the circuit breaker went out, and at the end of these 10 seconds the readings showed 140 amperes, 560 volts and 105 revolutions, normal speed. This is a remarkable showing. The extreme fluctuations are all recorded accurately and were caused by the short circuited car and the new fallen snow.



REPLOGLE'S RELAY WATER-WHEEL GOVERNOR.

## Thomson Arc Circuit Ammeter.

The standard instruments which the General Electric company has lately placed upon the market include the Thomson arc circuit ammeter, herewith illustrated. This is a high grade instrument for switchboard purposes and is mounted upon a black enameled metal base, with the cover, binding posts and screws of bright nickel. It measures over all eight by eight inches. The qualities claimed for this instrument are a high degree of accuracy, permanent reliability for service and an absolute dead-beat movement of the pointer. The scale is long and may be clearly read from a distance. One ammeter may be used for either half or full arc circuit, the divisions being wide and the calibration marked for both services. Permanency of calibration is obtained by the elimination from the instrument of any parts liable to change. Each ammeter is provided with a self-contained and conspicuous polarity indicator, consisting of two signals—the white showing under normal conditions, the red on reversal, the latter remaining in sight until the current has once more passed through the instrument in the proper direction. The ammeter may be used for front or back connections, connection posts and studs being furnished as conditions require.

THOMSON ARC CIRCUIT AMMETER.

## Safety Device for Trolley Wires.

A. E. Hutchins of Detroit, Mich., has invented an appliance to render a fallen trolley wire harmless and prevent obstruction to traffic on the streets. It is similar in form to the common ear or hanger for the trolley wire. But it serves the double office of both supporting the trolley wire and of automatically releasing the wire from its grasp in case of a break on the line. In Fig. 1 is shown the ordinary form used at each support, whether held by span-wire or bracket. This safety hanger is constructed with an interior chamber into which hook the removable ears or terminals that grasp the wire. These terminals each have enlarged and hooked-like ends that normally hook up into the interior chamber of the safety hanger, and normally the strain of the suspended trolley wire (held by these terminal ends) pulls the inclined

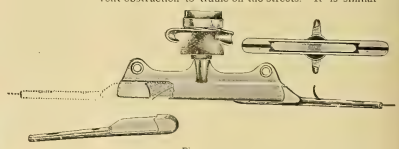


Fig. 2.

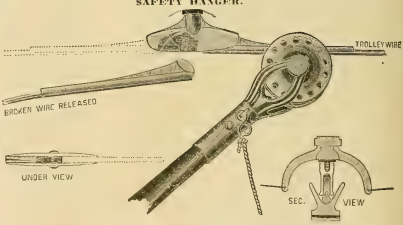



Fig. 1.

SAFETY DEVICE FOR TROLLEY WIRES

hooks against corresponding oblique ledges in the interior of this hanger, thereby both holding the wire up and also in tight electrical contact with the safety hanger. An electrical contact for 300 to 500 amperes is available in this small-sized hanger. The hanger or chamber part weighs three-quarters of a pound, and its terminal ears three-eighths pound each, made of cast brass.

When the trolley or suspended wire is broken, the weight of the wire at once releases its terminal hook from the safety hanger (and a spring may be brought into play to hasten its discharge). This action then automatically cuts off the current from the disengaged part, and also allows the wire to fall to the ground instead of hanging in the way. In the sectional view (Fig. 1) is shown a safety hanger as held in position by a double pull-off insulator (shown held by span wires). Between the interior walls of the safety hanger is shown enlarged head of terminal, which grasps a section of the new style ("figure eight") trolley wire. Under this is a section of a trolley wheel, its flanged parts both contacting the outer wall of safety hanger and the trolley wire, as it passes adjacent terminals or ends of the wire.

Fig. 2 represents a bridle form of safety hanger, with terminals made to hold the ordinary round trolley wire. Mr. Hutchins states that when his safety hanger is suspended by even very slack span wires, their swaying and pulling back from a break occurring on the trolley line does not cause other than the broken section to become released. But the sudden jerk or pulling back of the remaining line tends to hasten the release of the broken section of line, but does not interfere or disturb the balance of the line.

In case of the breaking of a trolley wire where the safety hangers are used, it will be found that a section has simply been cast out of the safety hanger to fall prostrate to the ground. An approaching car may, by its momentum, be propelled over the prostrate piece of trolley wire, pass the open section of line and continue its trip. A passer-by need not hesitate to drag the dead piece of trolley wire to the side of the street. When the repairer arrives he simply hooks in a new section of trolley line; a large force of emergency men is not needed. This form of safety hanger, having its engaging parts under cover of its interior chamber, is protected from exposure, sleet and dust. The engaging ledges to the safety hanger are inner cut in such a way that the strain of the suspended line tends to hold the walls of the hanger together instead of tending to spread the chamber.

## COMMUNICATION.

### Automatic Starter for Electric Elevator.

*To the Editor of the* WESTERN ELECTRICIAN:

On looking over H. Cochrane's article on "Problems in Electric Elevator Work," which appeared in your last issue, I note that in reviewing the different forms of automatic rheostats used in connection with electric elevators, he gives a very accurate description of the advantages gained by the use of a rheostat actuated by the power of the elevator motor, but closes with the statement that some of the troubles of this type of starter are noisy engagement of the clutch, liability of the driving belt to slip, and not to cut out resistance, and failure of the magnet to act properly at times. As owner of the primary and detailed patents on this type of starter, I must protest against the injustice of this criticism. In an article, published some three years ago, particular attention was called to the fact that the controller should be direct-coupled to the armature shaft, thus affording absolutely positive movement. The engagement of the worm was accompanied by much less noise than was made by the release of the magnetic brake, and was scarcely noticeable, as both acted at the same instant.

Finally, the magnet of the starter, being a simple shunt, has proved quite as reliable as any part of the motor equipment.

I think that Mr. Cochrane will agree that an elevator, handled by a controller, direct-driven from the armature or winding drum shaft, by means of one simple shunt magnet, will furnish as reliable a piece of apparatus as can be expected for such work.

*Baltimore*, June 1, 1896. G. H. WHITTINGHAM.

### Municipal Ownership in Practice.

[From the *Rochester Herald.*]

The Philadelphia *Ledger* brings to light some of the blessings of municipal ownership of gas works, which some philanthropists think would materially hasten the millennium. It has been found that the municipality itself consumes one-seventh of the production. Since it costs nothing, the city officials feel warranted in burning all they possibly can. Some of them have been known to keep the gas burning at full head in broad daylight. The municipal consumption of gas this year over last is 15,000,000 cubic feet. The gas unaccounted for by leakage, etc., amounts to 1,002,140,315 cubic feet, or one-fourth of the entire production. Could a private corporation, composed of respectable but tight-fisted gentlemen bring greater loss upon the city?

### A Third-rail Surface Electric Railroad for New England.

[From the Boston correspondent of the WESTERN ELECTRICIAN.]

The New York, New Haven & Hartford Railroad company is to extend its electrical equipment, which was so successfully inaugurated on the Nantasket Beach branch a year ago. Contracts were recently signed between the officers of the railroad and the General Electric company for the equipment of 43 miles of road from Nantasket Junction to East Weymouth, a station on the South Shore branch of the road. The Nantasket Beach branch is equipped with the overhead trolley system, but the contract for equipping the line from the Junction to East Weymouth calls for the use of the third rail. This rail is supported on short wooden posts, which are boiled in vacuum pans and treated with a preparation of tar, which has been successful for this purpose. These insulated wooden posts are then let into the railroad tie. A sliding contact shoe is used. The third rail is in the center of the track. It is laid in sections 30 feet long, bolted to one another, and each rail is supported by two insulated posts. A potential of from 300 to 500 volts will be used on the line. One advantage of the system, in addition to its being maintained at less cost than the overhead trolley line, is its easy adaptability to the ordinary railroad. As to the danger of having unguarded charged rails on a railroad track, Col. Heft, the electrician of the New York, New Haven & Hartford company, and C. C. Pierce of the General Electric, state that if a man happened to step on the rail he would certainly get a shock, but the low voltage used renders it improbable that he would be killed. Both gentlemen said they never knew of a case of anyone being killed from contact with a current of such low voltage. The electricians admitted that contact with the charged third rail would not be the most agreeable experience a man could undergo, and the fellow who stepped on it might cut a few pigeon-wings on the track. On the other hand, attention is called to the fact that the rail is laid on railroad property, and really no one has any right to walk on the track, which would be trespassing. When the line is built some precaution may be taken for the protection of children and curious people trying to walk on the third rail. A suggestion that the slanting sides of the rail (it is of unusual shape) might be protected by wooden insulation being bolted on, and the chances of people stepping on the exposed surface on top minimized, was made by the electricians. This is one of the details that will be considered when the line is laid. Although the present contract only provides for the equipment of the South Shore branch to East Weymouth, still it is admitted that the railroad officials have in mind the continuation of the system to Braintree, an important junction 10 miles from Boston, and possibly its extension to Boston. This would admit of the running of electric trains from the city to Pemberton. A test of the third-rail attachment was made on a mile of the track, which had been laid from Nantasket Junction, and all were highly pleased with the result. The equipment does not interfere with the ready transfer to the overhead contact. So when the extension to East Weymouth is built the electric cars to the beach will use the present overhead trolley line on the Nantasket Beach branch, and on the South Shore road the trolley will be pulled down out of the way.

### Price of Copper Rising.

The *Engineering and Mining Journal* of June 6th says: The rise in copper is caused by consumers and the public finding consumption exceeding production. While supplies are offered freely, speculators absorb them readily. There is more demand for refined copper for India and elsewhere. A contract has been placed for French Pacific cable which requires 900 tons of copper wire. American electrolytic copper has been repurchased owing to reduced output of American mines. A financial paper asserts that the recent investments of the Rothschilds in Anaconda mining stock, where hitherto they had been content to buy the products, is a significant "pointer" of the growing value of copper ledges and of a coming boom in good copper stocks.

The city of Defiance, Ohio, at the last election, held in April, voted to expend $30,000 in the erection and maintenance of an electric plant for 100 arc lamps and 3,000 incandescent lights. Catalogues and proposals may be addressed to B. B. Kingsbury.

### Canadian Electrical Association.

The sixth annual meeting of the Canadian Electrical association will be held in Toronto, June 17th, 18th and 19th. The opening session will be held at 2 o'clock in the council chamber, Board of Trade building. Each day's meeting will be divided between the consideration of business of the organization and the reading and discussion of papers. Following is a list of the papers to be presented during the course of the meeting:

"Ocean Cables" (historical), Charles P. Dwight, Toronto.

"Acetylene Gas" (with demonstration), George Black, Hamilton.

"Meters," James Milne, Toronto.

"Consideration and discussion of the "Government Electric Light Inspection Act."

"Some Central Station Economies," P. G. Gossler, Montreal.

"Power Transmission by Polyphase Electromotive Forces," George White Fraser, Toronto.

"Operating Engines Without a Natural Supply of Condensing Water," E. J. Phillip, Toronto.

"The Outlook for the Electric Railway." F. C. Armstrong, Toronto.

Several of these papers will be illustrated by electric projection of diagrams, and the interest thereby greatly enhanced. Among the special attractions is the announcement of an illustrated lecture by James Milne, entitled "Radiant Matter," to be delivered in the rotunda of the Board of Trade, June 17th, showing Professor Crookes' experiments and also demonstrations of Röntgen rays. Interesting sciagraphs will be taken and exhibited. On June 18th at 5 P. M. there will be an excursion on the steamer Greyhound to Lorne Park. The annual banquet to members and ladies will be held at Hotel Louise, followed by moonlight sail on Lake Ontario, returning to Toronto about 11 P. M.

Arrangements are being made for an excursion June 19th by boat around Toronto Island, along the water front to Scarboro' Heights and return.

During the progress of the convention opportunity will be afforded for inspection of the power stations of the Toronto Electric Light company and the Toronto Railway company.

### Postal Telegraph Company's Underground Wires in St. Louis.

One noteworthy feature of the recent destructive tornado in St. Louis was the demonstration of the great value to the electrical companies themselves of the burial of conductors. This was shown by the experience of the Postal Telegraph-cable company, which, on the day after the storm, handled 250,000 words from St. Louis and delivered 15,000 telegrams in that city. At the same time the Western Union company was so badly crippled that it could handle only a tithe of the enormous volume of business offered to it. This great contrast was due to the fact that about two years ago the Postal company decided to bury its wires in the business center of St. Louis. The work was completed last year, and every wire, excepting the few connecting branch offices upon streets where there was no conduit, was safely stowed away beneath the surface. The officers of the company state that to this precaution and business foresight the company owed its escape from a disaster which under other circumstances would without doubt have been the most severe in the history of the company. As it was, the property of the Postal company was not damaged to any appreciable extent in the business center of the city. The Postal was further fortunate in that its cable was over the Merchants' Bridge, which was not damaged by the storm. It formerly had a cable over the Eads bridge, but that was taken out at the time the new cable was laid. As the Eads bridge was partially demolished, the old cable, had it remained, would have been destroyed.

In making mention of this interesting object lesson it is proper to mention the fact that the underground work and material of the Postal company in St. Louis were supplied by the Standard Underground Cable company of Pittsburg.

### Modern Practice in Interior Wiring.

In the course of his paper on the "Evolution of Interior Conduits from the Electrical Standpoint," before the National Electric Light association at New York last month, Luther Stieringer made the following statement:

The best experience of the past 15 years in interior wiring has demonstrated the following facts

First—Indiscriminate wiring with staples is universally condemned.

Second—Cleat wiring is admissible in exposed work

where the circumstances admit, but not in any concealed work.

Third—Wires imbedded in plaster, depending on the insulation only for protection are condemned.

Fourth—Lead-covered wires are also condemned, except where protected in a conduit.

Fifth—Wires in moldings do not afford mechanical or chemical protection, and are only admissible in surface work.

Sixth—Wires carried in plaster, and covered with split or zinc tubes to prevent injury by trowels, are condemned.

Seventh—Glass or porcelain insulators can only be utilized in special cases of exposed work.

Eighth—Paper tubes do not afford absolute mechanical and chemical protection.

Ninth—Insulated tubes covered with a thin coating of brass or other metals do not afford absolute mechanical and chemical protection, but, in exposed work, they are, to a certain extent, admissible.

Tenth—Woven fabric conduit does not afford absolute chemical and mechanical protection.

Eleventh—Heavy insulating covering, integral with the insulation, offers no absolute protection against mechanical and chemical injury, and is analogous to rubber tubing for gas distribution installed throughout a building.

Twelfth—Concentric wiring is practiced in England with satisfactory results, but it is not in use in the United States. It offers many possibilities in the direction of a solid and fixed system.

Thirteenth—Paper-lined iron or steel pipes, known as "iron-armored conduit," "builders' tube," "armorite," "Clifton," and plain iron or steel pipe, are the only conduits that can afford absolute security against mechanical and chemical injury and assure permanence.

## CORRESPONDENCE.

### New York Notes.

NEW YORK, June 6.—The Rapid Transit Commission, forced to abandon its underground plans by the Supreme Court, is considering plans for the extension of the elevated railroad lines. Seth Low tendered his resignation as a commissioner at Thursday's meeting. He says: "The recent decision of the Appellate Division makes constructive work under the present law impossible. It only remains within the power of the commission under existing conditions to do what may be possible to increase rapid transit facilities of the city by some enlargement of the elevated railroad system. This is in effect an entirely new branch of the subject, upon which personally I have no desire to enter. Others can protect the interests of the city in this particular fully as well as I, and at far less inconvenience." W. B. Parsons, the engineer, presented his final report. There is still outstanding, he says, one claim of $911, and that has not yet been paid. With it included, the commission's work has cost the city since June 18, 1894, $41,470.29, about $6,000 less, he said, than the Boston commission cost that city. This, he declared, was a good showing, as it was less than one-twelfth of one per cent. of the amount of cost of the proposed plan. Mr. Parsons volunteered his future services to the commission without salary, until such time as a new plan might be proposed to it.

President Clinton L. Rossiter of the Brooklyn Heights railway, is so well satisfied with the results following the setting apart of recreation quarters for the road's employes in the new Greenpoint car house that similar quarters are to be arranged for the men in the Ridgewood car houses, where 800 men gather at different hours of the day. A fine lecture or entertainment room will be fitted up in the car house, and there will also be bathrooms and other conveniences. The men will be allowed to read books and newspapers and play games during "off hours." The new car house in South Brooklyn will also be fitted up in a similar manner for the road's carpenters, painters and other workmen. This company has just divided $10,000 in money prizes to the most deserving motormen and conductors. The sum named was divided between 1,139 men, the average prize being about $9. President Rossiter thinks that the setting aside of $10,000 for those having records clear of accident has well repaid the company.

It is again asserted that the "Huckleberry" company has formed some kind of a combination with the New York, Elmsford & White Plains Railway company and that several new lines for trolley cars are to be constructed in Westchester county before the snow falls. At present there is a trolley line from this city to Mount Vernon controlled by the "Huckleberry" company, and the line has a branch which goes part way from Mount Vernon to New Rochelle. The line of the New York, Elmsford & White Plains Railway company at present extends from Elmsford through White Plains to Silver Lake Park, a distance of five miles. There is also a trolley line between Mount Vernon and Yonkers. Plans for extensions of the trolley lines which have been filed at the county clerk's office in White Plains indicate that lines are to be constructed between Mount Vernon and Mamaroneck, through New Rochelle; from Mount Vernon to White Plains, through Scarsdale and Hartsdale; from Elmsford to Tarrytown and on to the Sleepy Hollow Cemetery, and from White Plains to connect with the line to Yonkers. It will cost at least $2,000,000 to carry out the plans for the trolley extensions, railroad men say, and the capital stock of the New York, Elmsford & White Plains Railway company is only $60,000. A large increase of travel between the Hudson river towns and the towns on Long Island Sound is predicted as a result of one of the extensions, while other new lines may capture most of the passenger traffic between White Plains, the county seat, and the other towns of Westchester county. There is talk also of competition for freight traffic on the trolley lines.

W. F. O.

### Niagara Falls.

NIAGARA FALLS, N. Y., June 6.—The important announcement is made that the Niagara Falls Power company has awarded the contract for the extension of its wheel-pit to E. D. Smith & Co. of Chicago. The contract also includes the extension of the big power house over the wheel-pit. According to the terms of the contract, the work must be completed within one year. When finished the wheel-pit will have room for seven more turbines, making 10 in all, with a capacity of 50,000 horse power.

Good progress is being made in the erection of the iron skeleton of the new factory of the Pittsburg Reduction company on the lands of the Niagara Falls Hydraulic Power & Manufacturing company, and it is a substantial addition to the factories on the canal property. A pleasing bit of news is that this company proposes to erect a building of equal size on the opposite side of the canal, to be used as a finishing room.

The Niagara Falls Power company has made a contract with the Mathewson Alkali company for 2,000 horse power, which is one of the largest contracts so far made by this company. The new plant will be located east of the Pittsburg Reduction company's buildings. The Mathewson company now has a factory in Saltville, Va., one in England, and one is to be established in Russia. Work on the buildings will be begun at once. The plant at Niagara will employ about 150 men.

O. E. D.

### Washington, D. C.

WASHINGTON, June 6.—Senator Gray has introduced a bill to renew, amend and extend the act of Congress of August 15, 1876, granting to Celso Caesar Moreno and associates the right to construct and maintain a Pacific cable connecting the American and Asiatic coasts. Several of Mr. Moreno's associates in the original project are dead, but he says he has friends ready to join him now in pushing the enterprise. The present bill, which is in the hands of the committee on foreign relations, provides that work on the cable shall begin within three years after the passage of this act. The United States is not to be limited in granting charters to other companies. Mr. Moreno says that the outlook for the passage of his bill is favorable, because it seeks no subsidy from this government, and only asks a renewal of a charter once granted to him. He adds that Hawaii, China and Japan will readily aid the enterprise once it gets under way, and that English capital will also be forthcoming.

Representative McGuire, who is the author of the bill relating to the government ownership of telegraphs, and S. H. Bell, representing the International Typographical Union, appeared before the House committee on post-office and post-roads in support of the measure for government ownership of telegraph. Representative McGuire occupied most of the time, entering into minute particulars as to the operations and efficiency of his plan. At the conclusion of his arguments Mr. Bell announced that this would close the case as far as the Typographical Union was concerned, and submitted to the committee the report of former hearings, in which the measure was advocated. The matter is in the hands of a subcommittee of which Mr. Bromwell is chairman. Mr. Bromwell said that during the recess of Congress he would make a thorough investigation, and that if it was in his power to do so would make a report at the next session. P. B. Delany, the New York electrician, asserts that the government can establish a better system of both telegraph and telephone than is now in existence, at a cost of about $15,000,000.

It is probable that the first of July will see the beginning of operations on the F street electric railway, thus providing rapid transit facilities from East Washington to Georgetown. The new tracks and the conduits are practically completed. E. Saxton, the energetic contractor, who has worked a large force of men on the road with satisfactory results, states that the only backward part of the work was the construction of the big car shed at Fifteenth and East Capital streets. This shed is immense, covering three acres, and it will hold the complete stock of motor cars and trailers of the line. The cars to be used have not yet arrived, although they are ready at the factories. In many respects the construction of the F street line has been one of the most important mechanical undertakings of its kind ever executed in this city. The line contains over eight miles of double track, and has 36 curves and 10 switches. It crosses three separate line of cable road, and contains one section of track where a complete semi-circle must be made by the conduit. Considering that it is barely eight months since the work was first undertaken, and that for two months of that time nothing at all was done, it is evident that Contractor Saxton has grappled with a large undertaking.

The Tennallytown & Rockville electric line has been sold at auction. O. T. Crosby and C. A. Lieb were the purchasers at their bid of $36,000. These gentlemen are the principal owners of the Georgetown and Tennallytown railroads, and they were the second mortgage holders of their newly acquired property. There has been considerable trouble in bringing about the sale. Several injunctions were dissolved by the Maryland courts before the advertising and sale of the road were accomplished. The plans of the new owners with regard to the property are not known here.

T. I. P.

### New England News.

BOSTON, June 6.—The electrical apparatus and wiring at the pumping station of the Chestnut Hill reservoir in this city have been condemned by the inspector of the wire department. This electric plant was installed only last year, and yet the water commissioner has been forced to endeavor to have the alterations recommended by the inspector made. This will entail a cost of $5,000, as it is probable that new dynamos will have to be located at the pumping station. About $200,000 worth of machinery is located in the plant, and the report of the inspector makes it imperative that something should be done at once to protect this machinery, as the defective wiring may cause a fire. The inspector reports that the two dynamos used for lighting are old-fashioned and antiquated, and unsuited for the work. The dynamos are not self-regulating. The rheostats on the switchboards are mounted directly on wood. The inspector also reports that the wiring is very defective and dangerous, wood cleats being used in many cases, instead of porcelain, and the wires are run through brick walls and timbers without being incased in tubing.

The City Council of Pawtucket, R. I., has unanimously voted $100,000 for a municipal electric lighting plant. This is the final outcome of a contest between the local monopoly and the citizens, and the permissive act which the Pawtucket Gas company has been trying to have passed by the General Assembly has been thus effectively forestalled.

The Massachusetts Legislature has rejected by an overwhelming vote a bill to establish a board of telegraph and telephone commissioners. The rejection of this bill also includes the rejection of the proposition to have a temporary commission to investigate the subject of telephone rates and charges and report to the next General Court.

A bill is now before the Legislature asking for the incorporation of the Lancaster Railway company with a capital of $1,000,000, the company to have the right to increase its capital stock by the approval of the railroad commissioners to $10,000,000. The location asked for is in Boston to connect the two union stations. The bill allows the use of any system of elevated railway except the Manhattan system.

C. S. G.

### Northwestern Notations.

MINNEAPOLIS, June 6.—R. L. Penney and others have applied to the county commissioners for a franchise and right of way for an electric car line from Minneapolis to Lake Minnetonka. It is proposed to touch at Wayzata and later to build to Mound City, at the upper end of the lake. Work is to be begun in two years and to be completed in seven years.

The Postal Telegraph company has voluntarily begun putting its wires underground at Des Moines, Ia.

Thief River Falls, Minn., is thinking of having an electric light plant.

Eastern capitalists have secured a controlling interest in the Minnesota Point Street Railway company of Duluth, Minn., and will make improvements. As soon as circumstances will justify it, the owners will make it an electric line.

The council of Jamestown, N. D., is unable to make a contract for electric lighting, having no funds available.

The city of Fergus Falls, Minn., has a sliding scale of prices for furnishing electric lights, running from 65 cents per month for one light to 25 cents per light per month for 75 lights, and the council is now struggling with the question whether an owner of two separate buildings who puts in lights for both shall have the right to bunch the number of lights and claim the discount.

The Helena Water & Electric Power company of Helena, Mont., has been incorporated to build a dam across the Missouri river at Stubbs, Mont., and generate electric power, which is to be transmitted to Helena and East Helena, 14 miles. The plant at the dam will cost about $1,000,000.

The Electric Light company of New Ulm, Minn., has made a contract with the city to furnish arc lights for street lighting, and will enlarge its plant to include arc lighting.

A Minneapolis paper publishes a slight remonstrance on the way in which the council committee has failed to report on an underground wire ordinance, and saying that wires are being raised instead of being put down. It seems that there was an ordinance passed requiring all wires over buildings to be raised seven feet, and this is being done, but the matter of putting the pole wires down is being steadily pursued.

Nearly 100 ex-employes of the Twin City Rapid Transit company left the Twin Cities for Milwaukee, where they were to get transportation, 19 cents per hour and protection in their positions. When they found a strike on in Milwaukee many refused to work, and others who did could not endure the showers of bricks and quit, and are without means and want to get back to their homes and families.

The St. Louis River Water Power company of Duluth, Minn., expects to have work begun this year developing the power and generating it into electricity to operate mills at Duluth and furnish power for the proposed electric line from Superior to Cloquet, Minn., by fall.

The officials of Mankato, Minn., are negotiating to secure a municipal electric light plant.

Rockwell City, Ia., business men have raised funds to put in an electric light plant, and have let the contract. A franchise was granted some promoters several weeks ago, and it was expected that work would be begun at once, but the promoters were found to be short several thousand dollars, and it was feared the franchise would lapse. So the business men took the matter in hand and raised the money.

The Fort Wayne Electric corporation has sued the village of Sleepy Eye, Minn., for $1,040 for dynamos and electrical supplies. The village contends that the machinery was purchased under a guarantee which has not been kept, and refuses to pay until the machinery is brought up to the specifications.

John I. Wilson of Winona, Minn., is negotiating for the electric light plant at Mankato, Minn., but will not touch it if the city puts in a municipal plant. The city has been enjoined from doing the latter on complaint of a citizen, who avers that the bond issue is illegal. The case will be argued June 11th. C.

## PERSONAL.

The *Canadian Electrical News* reports that Thomas Ahearn of the Ottawa (Ont.) Electric company, well known in the United States, has returned from a trip around the world.

Thomas G. Grier, formerly with the Bryant Electric company, is now with the Western Electric company, having resigned his position with the former company on the 1st of June.

George Foster Peabody of Brooklyn was elected a director of the General Electric company at the annual meeting of the stockholders held in Schenectady on May 12th. He succeeds Thomas K. Cummins, Jr., and is the only new member of the board.

Alex. Dow has declined a reappointment as electrical engineer of the Public Lighting Commission of Detroit, with title of city electrician, and has accepted employment as manager of the Edison Illuminating company of that city. Will F. Conant, secretary of the Public Lighting Commission, has been appointed for the ensuing year as secretary and general manager, and to him all correspondence concerning the general business of the plant and concerning the purchase of supplies should be addressed. Walter D. Steele, at present assistant electrician, has been appointed city electrician and will have charge of the engineering department and of the operating and construction forces. Correspondence on purely technical matters should be addressed to him. These changes will take effect July 1st. The city of Detroit has lost a faithful public servant by the retirement of Mr. Dow.

## ELECTRIC LIGHTING.

The Common Council of Vicksburg, Mich., has been enjoined from issuing the $12,000 bonds for water works and $3,000 for electric lights recently voted on.

The officers of the Beacon Electric Light company of Chester, Pa., have signed the contract for lighting the city for five years. It is the intention of the new company to erect an entirely new plant and a different system from that now in use. The city will save $16,300 annually on the new contract. The new plant will be in operation by the end of June. The Chester Electric Light company will have to furnish light until the new company gets in operation.

William H. Cook was appointed receiver on May 29th for the Suburban Electric Light & Power company, which owns a plant at Fark Ridge, near Chicago. The appointment was made upon the application of the Chicago Title & Trust company, which is the trustee for the bondholders to the extent of $10,000. It was represented that the appointment of a receiver was necessary in order that threatened levies may not be made which would result in the stoppage of the plant.

The present contract for lighting the streets of Louisiana, Mo., a city of about 6,000 people, 100 miles north of St. Louis, on the Mississippi River, will expire about October 1st, at which time or before, the City Council will probably make arrangements for a plant operated under city control, make a contract with the present company or accept a bid from some other concern. Louisiana is said to be well located for the economical operation of an electric lighting plant, as it is compactly built. The mayor is Henry L. Hart, to whom all inquiries should be mailed.

## ELECTRIC RAILWAYS.

It's an odd sight to see cars from the Detroit, Grand Haven & Milwaukee steam railway passing up and down the streets of Birmingham, Mich. The Oakland Electric Railway company built a spur and switch connecting with the steam railway. Thus carloads of crushed stone are shunted on the electric tracks and put wherever needed with one handling.

Binghamton—the Parlor City of New York state—is a bright and attractive town and it has a successful and enterprising electric railroad company, which is sending its praises abroad in the land in the shape of a pleasing publication, "Picturesque Binghamton," which is mailed free on application. The work is interesting and handsomely illustrated and invites careful examination. No doubt, also, it will attract visitors to Binghamton, as it is intended to do.

There is no doubt about the popularity of the electric railway among the farmers of New York state. At Palmyra a meeting was held in the opera house to discuss the proposed electric railroad between Palmyra and Marion. C. H. Brigham, Thaddeus Phillips, George Farshall, Eugene Nichols and W. W. Williamson were appointed as a committee to confer with a committee from Marion. A resolution was unanimously adopted by which the citizens of Palmyra pledged themselves to secure the right of way for the Marion line free of expense to the company, should a road be built. A number of the land holders were present, and all expressed a willingness to grant a franchise and have the road pass their farms.

## TELEPHONE.

A. M. Fenton and others are contemplating putting in a telephone exchange at Rice Lake, Wis.

W. J. Kurtz has secured a liberal franchise for a telephone exchange in Belleville, Ill., and will endeavor to put in 300 instruments in business houses and 200 in residences. The Kurtz National Telephone company has been formed with a capital stock of $20,000. Mr. Kurtz, who has organized companies in Decatur, Ill., and St. Joseph, Mo., is the president, and E. T. Schweitzer is secretary.

The Lansing, Mich., telephone exchange, which was one of the first independent exchanges to be inaugurated in Michigan, has had a prosperous career. It commenced operations last October, and now has about 500 subscribers. It has connection with Mason and other neighboring cities and villages, and work on the state line is still under way. At a meeting of the board of directors recently the manager, A. R. Hardy, tendered his resignation because of the demands of private business, and ex-Mayor Frank B. Johnson was elected to succeed him.

## MISCELLANEOUS.

An English contemporary recently published a leading article entitled "The Dawn of the Horseless Carriage."

The twenty-sixth annual catalogue of the Worcester Polytechnic Institute of Worcester, Mass., for 1896, shows that this tried and influential school, of which Dr. T. C. Mendenhall is president, is flourishing and aggressive in its work. The register contains the names of 199 students, and considerably more than half the members of the senior class are taking the course in electrical engineering. This course is carefully planned, and students have the advantage of using the well chosen equipment of machinery and instruments in the Salisbury and Magnetic laboratories. Under the direction of such a distinguished scholar and capable executive as Dr. Mendenhall the Institute is sure to enhance its excellent reputation.

## TRADE NEWS.

The Village Council of Sherwood, Mich., has granted to Rheubottom & Bond of Union City, Mich., a 15-year franchise for a modern electric lighting plant. The service is to be an all-night one.

A new line of knife switches of superior quality and workmanship has just been brought out by the Fiberite company, manufacturer of Medbery specialties. The Mason Electric Equipment company, 1202 Fisher building, Chicago, is the selling agent for all of the Medbery material and carries a full line of knife switches and railway material in stock ready for immediate shipment.

The Orient Electric company of Youngstown, O., is proud of an order for 500 incandescent lamps from Jacarchy, Est, De San Paulo, Brazil, accompanied by a draft on the London and Brazilian Bank in payment. The order will be filled at once and the Orient company feels that with this start it is opening up a profitable territory for its goods, and that a good business will result in the future.

The Sioux City Electrical Supply company has been obliged to increase its factory to keep up the orders for telephone goods. Among the many orders now on the books is one for 1,000 dials and automatic central switches for the Automatic Telephone Switch company; 800 drop manual board for the Home Telephone company of Sioux City, to replace a board now in use; a 100 drop manual board and 70 telephones for Sheldon, and 75 telephones for Sibley.

Manager H. A. Palmer of the Akron Electrical Manufacturing company, Akron, O., visited Chicago last week. Mr. Palmer states that his company recently closed a contract with the American Foundry & Furnace company of Bloomington, Ill., to place a number of motors in its factory. By this change the American Foundry company calculates to save 60 per cent. in power. The Akron Electrical Manufacturing company is pushing its machinery most energetically, and shortly expects to bring out a new type of dynamo. It makes a specialty of incandescent dynamos and motors, and under its present careful and conservative management it is fair to presume that the company will command during the coming year a large share of the dynamo and motor trade of the country.

## BUSINESS.

The various types of multipolar dynamos and motors made by the E. & C. Electric company of Cleveland, Ohio, are fully described in recently issued catalogues. Information is gladly furnished.

An attractive catalogue sent out by the American Boiler company of 84 Lake street, Chicago, tells all about the non-drip and float valves made by this company. These goods are fully guaranteed.

The raw silk machine wipers made by the American Silk Manufacturing company of 311 Walnut street, Philadelphia, Pa., are recommended and indorsed by the boards of fire underwriters in St. Louis and Philadelphia.

The telephones of the Julius Andrae & Sons company of 225 West Water street, Milwaukee, are being widely installed and highly praised. The Whitemore Telephone company of Whittemore, Iowa, and the Cobleskill & Sharon Telephone company of Cobleskill, N. Y., are recent customers.

The Electric Appliance company is showing a particularly satisfactory line of fan motors for the summer trade. Its line of direct current apparatus includes the celebrated Dayton ceiling fans and the Acme 110 volt direct current desk or counter fans. In alternating apparatus it is still handling the celebrated Meston line of desk and ceiling fans.

The Ward Leonard Electric company of Hoboken, N. J., announces that it will hereafter supply the rheostats which have heretofore been made by the Carpenter Enamel Rheostat company. These appliances are well and favorably known. In addition the new company will supply rheostats and electric heaters made under patents of H. Ward Leonard.

The Standard Incandescent Lamp company of Clinton, Wis., has been reorganized with C. R. Hopkins, the well-known Chicago insurance man of Hopkins & Hasbrook, Chicago, as president and treasurer. With Mr. Hopkins as financial backer the company is now in an excellent position to follow the aggressive policy mapped out by its management, which states that the factory at Clinton is now running 17 hours a day. An experienced lamp man is now in charge and the company proposes to turn out a product second to none in the market. The Standard company feels that its lamp as regards efficiency and life is exceptional, as is evidenced by the claim of 1,000 hours average life. The company has opened headquarters in Chicago at 193 La Salle street, which will be under the direct management of President Hopkins.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued June 2, 1896.*

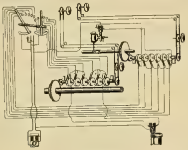
561,107. Door-lock Switch for Electric Lights. William E. Goucher, Jamestown, N. Y. Application filed January 2, 1896.

Among the features mentioned are a box or case to be secured in the door frame, and having one end open in line with the lock-bolt, spring plates secured at one end within the box or case, and thence extending forward and returned upon themselves, with their extremities normally in contact, an insulated switch-piece lying in the path of the lock-bolt, and having its inner end beveled and adapted to be forced lineally between the contacting ends of the springs when the bolt is projected on locking the door, a spring-arm or standard carrying the switch-piece, connections between the switch devices and main line wires, and lights in the circuit to be controlled by the movement of the door-bolt.

561,128. Trolley Switch. Moses Rangey and Peter Plante, Schenectady, N. Y. Application filed January 17, 1896.

A switch body is provided with uprights at or near each end, two movable rails pivoted to the uprights, but at opposite ends of the frame, each rail being provided with an arm at one end, which extends at a right angle to the rail, combined with a spring which has its ends connected to the arms to return the free ends of the rails to position after having been moved by the trolley.

561,144. Alternating Electric Motor. Joseph A. G. Trudeau, Ottawa, Canada. Application filed July 18, 1894.



NO. 561,271.

There are a rotatable armature, stationary energizing coils therefor, stationary field magnets located within the armature, and energizing coils encircling the field magnets, the armature coils and field coils being both connected with a source of electric supply, but in shunt relation to each other.

561,168. Trolley Stand. Frank N. Kelsey, New Haven, Conn. Application filed March 28, 1895.

Claim one follows: In a trolley stand, a suitable base adapted to be secured to a car-roof, a table mounted upon said base and having a swivel connection therewith, a spring retracted sheave or pulley carried upon said table, a trolley pole socket piece pivotally connected to said table, and a flexible connection passing about said sheave or pulley, and connected at one end to said socket piece and at its opposite end to a rigid support.

561,183. Electric Meter. Addison G. Waterhouse, Hartford, Conn. Application filed May 27, 1895.

An electro-magnet or other motor which is actuated or controlled by an electric current, and means for registering the movements of the motor, in combination with time mechanism, to which motion is imparted from the motor.

561,184. Hanger for Electric Lamps. William S. Weston, Etherly, Ill. Application filed March 4, 1895.

The combination is claimed with a supporting frame of a rotating lamp-supporting drum and its shaft, a continuous flexible lamp-supporting conductor or cable extending from the external circuit to the lamp, the cable being wound about the drum and having a slack portion extending from the drum to the point where the cable is connected to the external circuit or fixed in position, and a locking device for locking the drum to the frame.

561,185. Electric Lamp Hanger. William S. Weston, Chicago, Ill. Application filed May 22, 1895.

One claim is for the combination with a hanger-board of a drum engaging the hanger-board as a friction brake or locking device for the drum, and lamp-supporting conductor cables wound upon the drum.

561,205. Pole Piece for Electrical Batteries. Frank G. Curtis, Philadelphia, Pa. Application filed February 20, 1893.

The device consists of a carbon plate having electrically deposited thereon an alloy of copper and tin in specified proportions.

561,224. Electric Car. John C. Henry, Westfield, N. J. Application filed September 27, 1889.

The combination is claimed of two driving axles, having suitable cranks, a motor mounted on and between the axles by a non-yielding support, a crank operated by the motor shaft, and rigid connecting bar hung by rigid or non-yielding support on the three cranks.

561,225. Electric Car John C. Henry, Westfield, N. J. Application filed May 9, 1893.

There is the combination of the motor power transmitting mechanism connecting the shaft of the motor to the car axle, an air-brake system including an air reservoir, and an air pump suitably connected to the motor, and means under control of the operator for varying the positiveness of the connections with the axle and air pump.

561,271 Motor Controlling Device. Charles E. Ongley, New York, N. Y. Application filed November 2, 1893

The first claim is for the combination with a motor controlled electrically, of a series of commutators in the electrical connection to make and break the circuit at predetermined intervals operated by the motor, and means to control the circuit to any one of the commutators.

561,272 Electrically Controlled Steering Device. Charles E. Ongley, New York, N. Y. Application filed December 8, 1893

Means are provided for operating the rudder mechanically, and through an engine controlled electrically a motor is employed for operating the clutch mechanism, and means for controlling the motor electrically.

561,284. Electric Switch. Hiram Ross, Providence, R. I. Application filed February 17, 1896.

The switch lever described consists of the flat blade or conducting portion arranged to be pivotally secured to any suitable base or holder, a non-conducting guard member secured to and extending longitudinally of the blade, the guard member having insulating sides or cheeks extending across and practically concealing the working faces of the blade, and a handle secured to or integral with the guard member, by means of which the lever may be manipulated.

561,294. Electric Heater. Harry A. Thomas, Niagara Falls, N. Y. Application filed February 6, 1895.

Pipes of insulating material extend parallel with each other, spirals of bare wire are wound on the pipes, blocks of porcelain are placed at the ends of the pipes, metal rods pass through the pipes and blocks and are secured thereto, the blocks of porcelain being provided with grooves in the edges of the blocks, connection plates in the grooves, a pair of binding screws in each plate connected to the terminals of the spirals, and perforations in the blocks.

561,307. Electric Railway. Henry Brandenburg, Chicago, Ill. Application filed May 22, 1895.

A conductor having the external insulating covering and a longitudinal uninsulated oil channel on the upper surface for the trolley contact.

561,335. Telephone Exchange System. Kempster B. Miller, Wilkinsburg, Pa. Application filed February 18, 1896.

A terminal plug and its seat, an operator's telephone circuit and terminals therefor adjacent to the seat, and the arrangement being such that the tilting of the plug in its seat connects the terminals to the plug circuit.

561,354. Power Gearing for Electric Cars. Elmer A. Sperry, Cleveland, Ohio. Application filed February 16, 1895.

The first claim: In a motor car, an axle, a motor supported therefrom, means between the motor and the axle allowing for more or less relative movement between the two, a power-gearing connecting the motor and the said axle, a yielding coupling forming a part of such gearing, a halved casing inclosing the coupling mounted upon the motor, in combination with means for supporting either half while the other half is removed.

561,358. Microphone. George W. Sutton, New Rochelle, N. Y. Application filed April 14, 1896.

A microphone comprising a diaphragm carrying an electrode, a back supporting an electrode, each of the electrodes being surrounded by a fabric of a textile character, the electrodes being placed opposite one another with the edges of their surrounding envelopes in contact, whereby a chamber is formed and comminuted material contained within the chamber.

561,377. Automatic Telephone Call. Gerard Q. Dean and John Dean, Jr., New York, N. Y. Application filed August 3, 1895.

A movable contact-maker and contacts actuated by the contact-maker, combined with a movable core, a vitalizer for the core, and a detent actuated by and made to engage the core.

561,390. Dynamo-electric Machine. Alphonse I. Gravier, Paris, France. Application filed April 7, 1894.

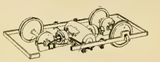
The combination with a core provided with a series of independent coil sections arranged in diametrically opposite pairs, of field magnets provided with recessed pole pieces, auxiliary coils extending around the upper and lower portions of the armature and non-magnetic supports for the coils.

561,395. Electric Locomotive. William P. Henszey, Philadelphia, Pa. Application filed October 4, 1895.

The combination of the frame, an electric motor mounted thereon, a crank thereon, a crank mounted on the frame, a two-armed lever pivoted to the frame and connected to the crank of the motor and the crank driving wheels, their axles, cranks on the driving wheels, and rods connecting the cranks.

561,416. Attachment for Telephones. John H. Miller, Washington, D. C. Application filed March 12, 1896.

An attachment for telephone boxes, consisting of a movable shield having guides on the face thereof, a hinged strap for attaching it to the telephone box, and a hook for holding it in position.



NO. 561,354.

561,417. Telephone System. Paul Minnis, Mobile, Ala. Application filed February 17, 1896.

The inventor claims the combination with a central station and a series of line stations of a single wire common to all the line stations, a series of service wires, each connected to the single wire and through the transmitter and receiver at a line station to the switchboard at the central station, a series of small talking batteries, and a corresponding series of flexible cords, each of which is severed, and its severed ends directly connected to the opposite poles of one of the talking batteries, the arrangement being such that the polarity of the talking batteries in the return wire is always the same.

561,418. Telephone Exchange System. Paul Minnis, Mobile, Ala. Application filed February 17, 1896.

The arrangement comprises a series of subscribers' circuits connected to a common return wire, a series of talking sets directly in the line circuits, and talking batteries in loop cords at the central station, the arrangement being such that the polarity of the several talking batteries in the return wire shall be the same.

561,419. Switchboard for Telephone Systems. Paul Minnis, Mobile, Ala. Application filed February 17, 1896.

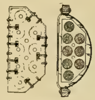
One claim is given: In a telephone switchboard, the combination with the line-jacks and plugs of contacts which complete a circuit for communication between two line stations over service wires and a common return wire, spring contacts arranged in the line-jack and normally closed to form part of a call-circuit, and having their ends adapted to be separated by the insertion of the plug, a visual call-signal operated by said circuit, which includes a normally open switch at the line station corresponding to said jack, and contacts normally separated but electrically connected by the plug to complete a circuit by which the visual signal is restored to its original condition.

561,420. Line-jack for Telephonic Switchboards. Paul Minnis, Mobile, Ala. Application filed February 17, 1896.

This device comprises a non-conducting body having an opening for the plug, two separated contacts, two normally closed spring contacts and a single spring contact, all insulated from each other and rigidly attached at one end to the outer face of the non-conducting body, and all entering the opening for the plug in the jack through longitudinal slots in the non-conducting body, in combination with a plug having a metal tip to engage and electrically connect the separated contacts, a non-conducting point to separate the two closed contacts, and a metallic body having an exposed portion to electrically engage the single contact, and couple it with the wire of the cord, and with an interior conductor in the jack.

561,421. Telephone Call Box. Paul Minnis, Mobile, Ala. Application filed February 17, 1896.

There is claimed the combination with a casing, of a reel journaled therein and having wound thereon the conductors connected with the receiver and transmitter, means for rotating the reel to wind up the conductors, a support for the receiver and transmitter, and mechanism controlled by the support for preventing the reel winding up the conductors when the receiver and transmitter are removed from the support.



NO. 561,294.

561,422. Telephone Call Signal for Central Stations. Paul Minnis, Mobile, Ala. Application filed February 17, 1896.

One claim is for a circuit-closing apparatus for telephone call-signal, consisting of a balanced armature forming part of the circuit, a post or contact arranged beneath one end of the armature and forming part of the circuit, independent magnets to attract the ends of the armature, independent circuits for the magnets, and a glass tube mounted on the armature and containing a globule of mercury.

561,423. Telephone. Paul Minnis, Mobile, Ala. Application filed February 17, 1896.

This apparatus consists of a single handle formed in two parts, brackets having collars screwed upon the ends of the the parts when united, and a receiver and transmitter, each mounted on one of the brackets.

561,424. Telephone Switch Plug. Paul Minnis, Mobile, Ala. Application filed February 17, 1896.

A plug for a telephone switchboard is described, comprising an insulating point having a metallic tip, a conducting body partly exposed, the remainder covered by a sleeve of non-conducting material, a spring-projected cap on the outer end of the plug having slots to receive screws which connect it movably to the plug, a contact ring and bushing in the cap, a wire of the flexible cord connected to the conducting body of the plug, and a second wire connected to the ring and bushing in the cap.

561,430. Indicator for the Speed of Revolution of Propellers. Mathias Pfatischer, Philadelphia, Pa. Application filed August 12, 1895.

The claim follows: In combination with a ship's propeller shaft or other rotary body, a magneto machine, mechanical operating connections between the said body and the said magneto machine, and an indicator circuit for the said magneto with a suitably graduated galvanometer included therein to indicate the speed of the said shaft or rotary body.

561,431. Telltale for Steering Gear of Ships. Mathias Pfatischer, Philadelphia, Pa. Application filed August 12, 1895.

In combination with a ship's steering gear and a source or sources of electric energy there are a series of contacts respectively connected with different portions or divisions of the source or sources, an electric telltale or indicator, a circuit or conductors therefor, one end of the circuit being connected to one point or division of the source or sources, adjustable switch connections for the contacts connected to the other end of the circuit or conductors to include more or less of the portions or divisions in the circuit or conductors, and mechanical connections from the steering gear for adjusting the switch connections.

561,443. Electric Lamp Hanger. Joseph Schmidt, New York, N. Y. Application filed February 11, 1896.

This hanger comprises a rotary spindle, means for rotating the same, a block for supporting the spindle and its rotating means, a cover for attachment to the block and having a slot in its lower side, and a tubular carrier movable in the slot.

561,498. Party Line Telephone Apparatus. William W. Dean, St. Louis, Mo. Application filed March 28, 1896.

A metallic circuit telephone line having two or more subscribers' stations thereon is described, the line being provided with two limbs adapted to be temporarily united at the central office through branches or extensions thereof, the branches including a retardation coil, a battery being connected at the central office to the center of the retardation coil, whereby the metallic circuit thus formed is balanced, while voice currents sent between any two stations on the line are prevented from being shunted.

561,530. Electric Car Truck. John Taylor, Troy, N. Y. Application filed April 29, 1895.

In a truck frame the combination of the top frame, pedestals and connecting bars, the truss bars, the motor bars set edgewise but twisted near its ends, the elliptic springs and bolster, and the bracket castings having flanges and wings.

561,547. Automatic Telegraph. Samuel P. Freir, Hasbrouck, N. J. Application filed August 9, 1893.

In an automatic telegraph apparatus for transmitting messages to siphon or equivalent recorders there is the combination of main-line transmitting apparatus by which the positive or negative pole of a battery or batteries may be directed to line, and variable pressure main-line contact devices, whereby the touch of the fingers in the manual transmission of messages of such character may be reproduced.

Western Electrician.

EVERY SATURDAY.

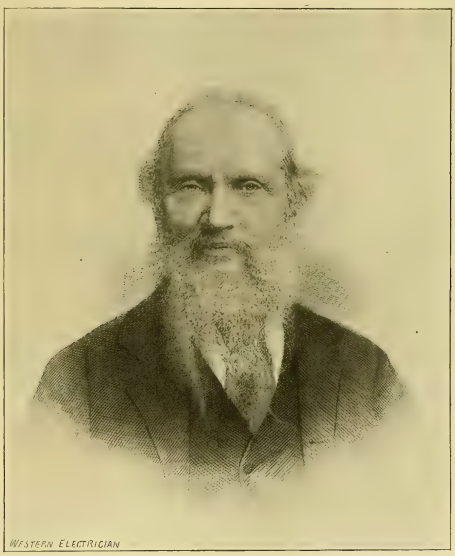
Vol. XVIII. CHICAGO, JUNE 20, 1896. No. 25

## Lord Kelvin's Jubilee.

This is the week of a most interesting celebration in Glasgow, as the scientific world is paying tribute to the genius and accomplishment of one who is perhaps the most eminent of living physicists -Lord Kelvin. This peer is probably more widely known as Sir William Thomson, although he has borne the loftier honor for over four years, but it is fitting, even in democratic America, that he should be addressed by his title as a baron, as it is believed that he furnishes the first instance in the history of the United Kingdom of a man being raised to the dignity of the peerage entirely in recognition of scientific attainments. Apropos of the question of title, it is related that the Vienna correspondent of a daily paper in England recently made the amusing blunder of solemnly asserting that among the scientists to receive honorary degrees from the Budapest University, on the occasion of the Hungarian millennium, were "Lord Kelvin (London) and Sir William Thomson (Glasgow)."

The occasion of the present celebration is the fiftieth anniversary of Lord Kelvin's professorship at the University of Glasgow, although it is interesting to remark that the great scientist's birthday comes in June, and that he also attained the honor of knighthood just 30 years ago. The celebration will last three days and will include a reception, an exhibition of Lord Kelvin's inventions, the presentation of addresses from various bodies to the central figure of the occasion, the conferring of honorary degrees and a banquet. Representative scientific men—about 50 in number—from America and the British colonies and from all the European countries, and about 150 from Great Britain and Ireland, have signified their intention to be present. The official American representative is Thomas Commerford Martin, editor of the *Electrical Engineer*, who is delegated to be present by the American Institute of Electrical Engineers and the National Electric Light association. Mr. Martin sailed from New York on June 6th. Another interesting delegation is that representing the University of Cambridge, England, the *alma mater* of Lord Kelvin. It consists of Prof. Sir G. G. Stokes, Prof. A. R. Forsyth and Prof. J. J. Thomson.

The distinguished Irishman who is accorded these unusual honors is eminent in several of the natural sciences and is renowned as a mathematician, but his fame rests chiefly on his work in studying electrical phenomena and in making practical application of the knowledge gained in his researches. He is rightly classed with that illustrious group of nineteenth century scientists which has expounded the underlying laws of Nature on which all the superstructure of electrical development rests and which bears the names of men like Faraday, Maxwell, Henry and von Helmholtz. In addition he is an ingenious mechanic and a practical engineer. To-day Lord Kelvin is regarded as the highest living exponent of electrical science by electrical men the world over. The list of his honors indicates his reputation. He is LL. D. of the Universities of Edinburgh, Cambridge, Dublin, Montreal and Bologna; D. C. L. of Oxford; M. D. of Heidelberg; F. R. S., P. R. S. E.; foreign associate of the French Academy of Sciences; a grand officer of the French Legion of Honor; commander of the Belgian Order of Leopold, and knight of the German order "Pour le Mérite;" reëlected in 1872 a fellow of St. Peter's College, Cambridge; is now for the third time president of the Royal Society of Edinburgh; from 1890 to 1895 president of the Royal Society, London, and in 1871 was president of the British association at its meeting in Edinburgh.




LORD KELVIN (SIR WILLIAM THOMSON).

William Thomson was born in Belfast in 1824, but he has passed his life in Glasgow, where he is a great figure. He has often been urged to remove to Cambridge and elsewhere, but he has staunchly adhered to Glasgow and its University, which so early in his career appreciated and rewarded his genius. The citizens of the Scottish metropolis are very proud of him.

In reviewing the career of Lord Kelvin the WESTERN ELECTRICIAN can do no better than to quote liberally from a very interesting article in *Good Words* by a British writer.

If heredity means anything, Lord Kelvin was predestined to be a mathematician, for his father, James Thomson, LL. D., was a born man of science and a thorough mathematician. I well remember him as professor of mathematics in the University at Glasgow at the time when the future Lord Kelvin was beginning his career in the chair of natural philosophy. His influence was such as only a strong man could have exercised, and many a student who caught inspiration from his teaching gained distinction afterward. He was the son of a farmer in the North of Ireland, with few outward advantages; but his inborn thirst for knowledge overcame all difficulties. William Thomson was in this way saturated with mathematics almost from his cradle. His father undertook complete charge of his education till he was 10 years old, quickening his latent genius into activity, and training him with such skill that the boy, directed along the best methods of work, which had been made exquisitely clear to him, advanced by leaps and bounds into the very arcana of the exactest of all the sciences. His classical and general education was likewise carefully attended to by his father. He was matriculated as a student in Glasgow at the early age of 10 years little more than out of his childhood. He was a mere youth when he went to St. Peter's College, Cambridge, and at the age of 21 he passed as second wrangler, and was first Smith's prizeman. But ere he had won these honors he was already famous, for his contributions at 18 years of age to the *Cambridge and Dublin Mathematical Journal* had attracted the attention and excited the wonder of the scientific world in France as well as in England, by their boldness, originality and accuracy. He was shortly afterwards made editor of that famous journal, and gathered round him a brilliant staff of writers; yet it was his own papers which chiefly aroused the attention of scientists. When 22 years of age he was appointed to the chair of natural philosophy in Glasgow, which he has now occupied for 50 years, and which will forever be associated with his name. The University building in which he then lived and for many years taught was the old and venerable college in the High street, among the very slums of the city, and in every way in marked contrast to the palace of learning which now dominates the hill to the west of the city, at the foot of which runs the turbid stream, the Kelvin, the name of which Sir William Thomson took for his title as a peer.

Whatever he does is done thoroughly, and must rest on absolute truth. For while he is a wonderful experimentalist, bringing all his vast learning in chemistry and dynamics to the aid of his mechanical skill when engaged in any research, yet it is his mathematical genius which forms his most powerful instrument as a physicist. He must reach the mathematical formula which exactly determines the relationship of the question on hand. His fame as an electrician is so unrivaled that many people imagine that this constitutes his only claim to distinction. For it is to him we are indebted for the success of the cable which unites England and America, and which has made possible the success of the submarine wires which now spread like a network on the bed of ocean after ocean. For years the Anglo-American cable appeared impossible. The first attempt ended in loss. But Lord Kelvin brought to bear upon the problem such a knowledge of the laws of energy, as well as electricity, that, like a second Columbus, he reached America, and the message of peace, "Glory to God in the highest, on earth peace and good will toward men," was flashed from land to land. The honor of knighthood, then bestowed on William Thomson, was but a faint expression of the admiration felt for the man and his achievement.

Lord Kelvin's patents are of many kinds, and so numerous and valuable that a large workshop in Glasgow, filled with skilled workmen and under able scientific management, is occupied chiefly with their production. The sea has been to him a life-long passion. For years he was a keen yachtsman, and the Lalla Rookh, which he used to navigate to a large extent himself, served as an instrument both for enjoyment and research. While he sailed on her far and near, he was perpetually engaged in investigation. These experiences led him to invent certain instruments which have proved invaluable to seamen. In 1874 he contributed to *Good Words* a paper on the mariner's compass, and it is interesting to remember that at that period he was perfecting his modification of the magnetic compass which, in common with his patent sounding machine, has proved one of the greatest boons ever bestowed on navigation. I remember the pleasure with which the weather-beaten captain of a P. and O. steamer learned that I knew Lord Kelvin. "He is the greatest friend of the sailor who ever lived," he told me, "for in giving us his compass and sounding line he has insured a safety we never had before."

Attached to his classroom in the university there is a magnificent physical laboratory, splendidly equipped, in which a large staff of accomplished assistants is continually engaged, under the superintendence of his nephew, Dr. Bottomeley, himself a man of high scientific attainments. It is a most picturesque scene that is presented when, going from the sunlit court, one enters this great magician's cave, with its maze of crucibles, pulleys,

pumps, levers, and ranges of tables and shelves covered with instruments and appliances; and, when climbing from floor to floor, there is discovered in every corner mysterious arrangements indicating experiments at different stages. From above the long desk in his classroom the ceiling opens aloft, so as to admit of apparatus being used which require height. And here the famous man lectures and experiments before the students, who are ranged on the benches that rise in an amphitheater around. His enthusiasm when some critical experiment is being conducted is marvelous. He beams with interest, and everything else appears forgotten for the moment. Each assistant has to be on the alert, while he, using when necessary all his own physical energy, gets so absorbed that sometimes rude students, aware of Lord Kelvin's abstraction, will take the opportunity of making some witty commentary of which the lecturer is entirely unconscious. He is in another world, and neither hears nor heeds the doings of the foolish.

He has one strange peculiarity. While the higher mathematics and all the mysteries of logarithms and the calculus are as easy to him as the alphabet, he often appears puzzled when a sum is presented to him in ordinary numerals. A question of simple addition placed in this way on the board will sometimes lead to the query being put to the class or to an assistant, with a certain funny look of helplessness, "How much is that?"

His power of abstraction from all surroundings, becoming dead to what is near him, and lost in intellectual processes, is quite extraordinary. He is never without guished student, but an accident which befell him many years ago, when enjoying "the roaring game" of curling, lamed him for life. The intrepid manner in which, despite his weakness, he throws himself into all manner of work, and the unsparing energy with which he attends to every detail of duty, rushing to London and back to his class as if such rapid journeys were a pastime, reveals the burning enthusiasm of his nature. His contributions to strictly popular literature are unhappily few, for he is so painstaking that writing articles of that nature is exceedingly irksome to him. "The Nature Series" has, however, several volumes by him of "Popular Papers and Addresses"—the unwary must, however, not understand "popular" too literally in this connection. In conjunction with Professor Tait of Edinburgh he has published what is the best text-book on natural philosophy extant.

With the exception of the first eight years, Lord Kelvin has spent the whole of his life in Glasgow College. He has a charming house at the extreme end of the Professors' Court, with windows looking over the college grounds. The house is an epitome of applied science as regards lighting and ventilation, and at every turn one meets indications of wires and telephones connecting the house with the laboratory and elsewhere. A large astronomical clock stands in the hall. He has a large and delightful house at Largs in Ayrshire, looking out on the Firth of Clyde and the greater and lesser Cumbraes.

He has been twice married; his first wife was Miss Crum of Thornliebank, a most charming and bright companion, whose early death was a terrible blow to his affectionate heart. The present Lady Kelvin, formerly Miss Blandy, seems to have been made for him, strong both in head and heart, of wide sympathies and most engaging kindness.

It may be added that Lord Kelvin's researches in electrostatics and magnetism were collected and published in one volume in 1872, while his "Mathematical and Physical Papers" have been issued separately in several volumes.

## Quality as Important as Quantity.

Possibly too much emphasis has been placed on mere quantity of circulation, with the result that all sorts of expedients are adopted to spoil as much white paper as possible. The most enduring method of creating a permanent and really valuable circulation is the making of a good paper every day. What you so build up will have a solid foundation. There are not wanting signs that judicious business men are beginning to think more of the character of circulations, and less of the mere tonnage issued—no matter by what affidavits supported.—*Newspaperdom.*

## Copper as an Insulator.

[From the *Electrical World*.]

Copper instead of steel will be used for insulation on the tracks, and every precaution has been taken to minimize the exposure of the circuit wires and the live track apparatus.

[From an account of the electrical transformation of the Lakeshore L. road.]

## Equalizer Systems of Distribution.[1]

By A. Churchward.

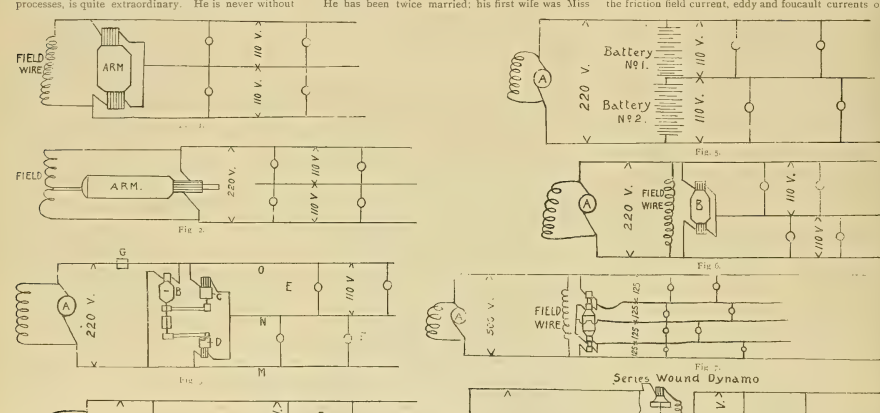
In preparing the following paper, the limited scope of which is indicated by its title, I have assumed that a three-wire system is supposed to be the only safe and reliable system of direct current distribution for motors and lights in our cities.

It is my intention to refer to the many methods that have been devised to accomplish the results obtained by the three-wire system without the use of a divided source of electrical energy and a compensating conductor connected to the point of division. I now lay before you an abbreviated list of such methods.

(1) Using a single dynamo with two commutators. Very little would be gained by this, even if it did not infringe the foregoing system, as one commutator on a large machine is all most people can put up with.

(2) I do not think that at this late day anyone is likely to try the combination of a 220 volt dynamo and two sets of lamps connected in series by a third wire.

(3) This time we come to a true system of equalizer distribution. We have only one generator of, say, 220 volts *A* and two small machines *C* and *D*, capable of taking care of the unbalance due to turning off lights on either side of the circuit, and a motor *B* connected to the two outside mains and driving the two machines *C* and *D*. In this system our comparative loss is quite great at light loads, as we have a constant loss due to the friction field current, eddy and foucault currents of




EQUALIZER SYSTEMS OF DISTRIBUTION

three machines. Another disadvantage is the difficulty in keeping the system properly balanced, owing to drop in speed of motor with increase of load, drop in voltage of one of the machines *C* or *D* when running as a dynamo (due to armature reaction and C R losses in the armatures), and, on the other hand, the load being taken off, the voltage will be raised on the lightly loaded side. The action that takes place is this, and will be found nearly the same in all equalizer systems. When both sides of the circuits *I* and *I'* are equally balanced, the motor *B* runs free, only taking enough current to keep *C* and *D* up to the proper electromotive force. Should the load be changed, however, so that *I* had 20 amperes and *I'* 10, then there would be unbalance of 10 amperes. An ammeter placed in the circuit at *G* would indicate 15 amperes, the amount of current to run combination *B*, *C* and *D*. Fifteen amperes would flow from the main *O M* to *N*, and the machine *D* would act as a dynamo and supply the other five amperes. On the other hand, the machine *C* would take the five amperes from the neutral *N*, and run as a motor, helping to drive the motor *B*. Thus it can be seen that under ordinary conditions we can dispense with the motor *B* and couple *C* and *D* together, as per diagram. But by using the motor *B*, a greater load on one side can be taken care of.

(4) Using a dynamo 220 volts *I* and a small machine of 110 volts *C*, driven by a motor *B* connected across the 220 volt mains. The motor *B* drives the machine *C* so that the pressure across *I* and *I'* is equal, should the load be increased on *I*, the pressure will fall and the machine *C* will supply the extra current needed to balance the pressure of the load on *I* to less than on *I'*.

[1] Read before the National Electric Light Association, New York, May 6, 1896.

then C will run as a motor, driving B as a dynamo. In this case also there will be a slight unbalance of pressure, due to armature reaction, etc.

(5) Still another method has been proposed. This employs a single dynamo of 220 volts. To the brushes of this machine are connected the two outside wires; the neutral wire is connected to the center of the armature coils, and this raises a potential midway between the two outside wires.

(6) A system in use in central stations in Europe might be mentioned here, but we can hardly call it an equalizer system. It consists of a 220 volt dynamo and two sets of batteries. The accumulators here play the same part as their namesakes do in a system of hydraulic supply. The battery connected to the circuit that requires most current discharges into the circuit, and thus helps the dynamo, and the battery in which the demand is smaller is charged by the surplus current. There is no economy in an installation by this method over others, the accumulation costing much more than a rotary equalizer. We gain this much, however, during the hours of light load the batteries may supply all the current required, permitting the shutting down of the central station during those hours.

(7) I intend now to bring to your notice an equalizer that has passed the experimental stage and has been in operation day and night for $2\frac{1}{2}$ years, no lamps have ever been lost owing to lack of balance of the system. Again, we only require one generator A, 220 volts, and one small machine with two commutators B. We have only two bearings to worry about, only one field loss, one loss due to hysteresis and eddy currents, and absolutely no armature reaction. There being no armature reaction, there will be no drop in speed, no sparking at the brushes with a change of load, and the capacity of the equalizer will be the heat limit of the armature winding.

(8) By using the equalizer system we have one unit, or set of units, running at a high efficiency, and for a reserve we have only one machine. It is not limited to only 220 volts. Where a company has a motor trade much scattered it can take, for instance, 500 volts and run a good distance with economy, then put an equalizer in a central location and supply its customers with lights at 110 to 125 volts. Or, again, we want light and power in one unit. We can take one generator, 50 kilowatt, 250 volts, and a motor of 50 horse power but with two commutators; or, in other words, on a 50 horse power equalizer we can take either the full load in power off the pulley or the full number of lights off one side at 110-125 volts, or in any proportion we see fit. Still another advantage of this system: We can always compensate for the drop in our line at any point independent of all others. This we might call a booster equalizer system. When the heaviest loads are on our system and the sides balanced, all the equalizer does is to run free as a motor. Now, by attaching a small series wound dynamo to the end of the shaft of the equalizer, and adjusting it to the load and drop, we will first boost our pressure and then equalize it. So that, given a district with various points of distribution and various drops, we can run even the longest and heaviest loaded circuit at the same pressure as our station electromotive force.

DISCUSSION.

MR. EDGAR: It seems to me that these systems have got one weakness, depending upon one inherent difficulty. Every one of these systems, as I understand it, will go to pieces if you get the neutral wire against the outside wire. Am I right there? If the neutral wire gets on the outside wire, are you not going to burst all the lamps on the outside?

MR. CHURCHWARD: No, sir.

MR. EDGAR: Let me assume a case. Supposing you have got the maximum capacity on your generator; that generator is going to sustain 220 volts between the outside wires without question.

MR. CHURCHWARD: Yes.

MR. EDGAR: Then do you claim your equalizer is going to sustain the entire capacity of that generator?

MR. CHURCHWARD: Yes, sir.

MR. EDGAR: Assuming that you are running at full capacity?

MR. CHURCHWARD: If you are running your generator at full capacity, it will take very little more current to show the trouble.

MR. EDGAR: We do not have either in the three-wire system. We simply keep on going until something burns off. It seems to me your equalizer has got to have an ampere capacity equivalent to the total ampere capacity of your station.

MR. CHURCHWARD: No; because we wind the equalizer with a large wire.

MR. EDGAR: It has got to have balance and everything equal to the total capacity of your station.

MR. CHURCHWARD: A very small wire will stand a tremendous current.

MR. EDGAR: You are going to have an equalizer that will stand an overload?

MR. CHURCHWARD: They will stand an overload. The point is to get around the three-wire system. I put it at the beginning that it was the object to get around the standard three-wire system. I was not putting that as equal to the three-wire system.

MR. EDGAR: We tried that same experiment three or four years ago, when it was comparatively new. Of course we got into a circus at once, and I have never seen a scheme of the kind that did not get us into that same trouble.

MR. CHURCHWARD: The same point you speak of was brought up at the time I was starting this, and we have been looking for it ever since.

MR. EDGAR: It seems to me you are practically putting as much money into your dynamos as if you had the three-wire system.

MR. CHURCHWARD: I quite agree with you.

MR. EDGAR: I thought your principal point was that on your equalizers you were going to be able to put in very small machines, comparatively.

MR. CHURCHWARD: No, that is not the point.

MR. FERGUSON: As I understand it, Mr. Churchward proposed to have these small equalizers scattered all around town.

MR. CHURCHWARD: In each large block.

MR. FERGUSON: Not in the central station?

MR. CHURCHWARD: No.

MR. FERGUSON: Then you do not contend that it begins to compare in point of economy.

MR. CHURCHWARD: No, sir. I do not. I say that the system is put there as a method of getting around the three-wire system, irrespective of economy.

## Effect of Temperature on Insulating Materials.[1]

BY GEORGE F. SEVER, A. MONELL AND C. L. PERRY.

In designing electrical apparatus, it is often of the greatest importance to know the effect of different temperatures on the insulation to be used in its construction.

Of the many kinds of insulation, a few of the most common were chosen, paper, cloth, oiled paper and oiled cloth, and the following conclusions have been

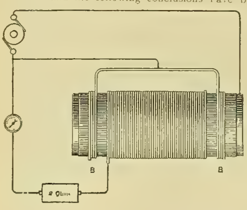


Fig. 1. Connections for testing.

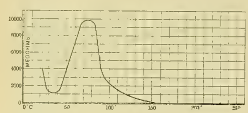


Fig. 2. Plain red paper .009 inch thick. Characteristic paper curve.

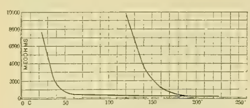


Fig. 3. Japanned red paper .01 inch thick. Characteristic curve.

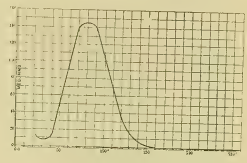


Fig. 4. Plain cotton duck .04 inch thick. Characteristic cloth curve.

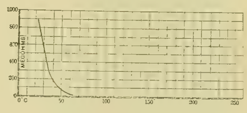


Fig. 5. Oiled paper .0045 inch thick. Characteristic curve.

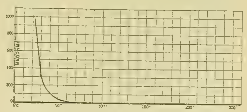


Fig. 6. Oiled silk .007 inch. Characteristic curve of oiled cloth.

EFFECT OF TEMPERATURE ON INSULATING MATERIALS.

drawn from the result of 102 tests on samples of materials, which were kindly furnished by several of the most prominent manufacturers of electrical machinery.

*The Apparatus.*—The heating apparatus consisted of a glass cylinder eight inches in diameter and 10 inches high, covered at the top and bottom with asbestos plates. The lower part of this cylinder was occupied by 12 enamel resistance tubes, five inches long, and 24 ohms each. The terminals of these were brought out through the asbestos plate. The current in these tubes being controlled by a rheostat, the temperature in the cylinder could be varied at pleasure. An inch above the heating tubes, and supported by an asbestos collar, was a metal plate having holes punched in it to allow the free circulation of air in the cylinder. This plate was connected to one side of a galvanometer.

The insulating material to be tested was wrapped on brass cylinders three-quarters inch in diameter and three inches long, the insulation not reaching quite to the end of the tube. The insulation was then wound with No. 26 B. & S. bare copper wire for a space of $2\frac{1}{2}$ inches. Five tubes so wound were then placed on the metal plate in the cylinder and their terminals brought up through the asbestos cover, and then to a switchboard, in order that any tube might be thrown into the galvanometer circuit. This arrangement made it possible to heat five specimens at one time. With the apparatus described was used a Thomson high resistance galvanometer, a megohm box and a difference of potential of 500 volts. The thermometer used was of the nitrogen-filled mercurial type and capable of measuring from 0° to 400° C.

When troubled with surface leakage, it was eliminated in the following simple manner. The diagram shows the connections while testing a tube and at the [illegible]. It will be seen from the diagram, Fig. 1, that all of the current going through the galvanometer must pass from the dynamo to the brass cylinder and thence through the insulation to coil A and on through the galvanometer. Any current tending to leak over the surface of the insulation from the brass cylinder to coil A will be intercepted and shunted past the galvanometer by coils B B.

During the investigation many different specimens of paper, oiled cloth, etc., varying greatly in thickness and composition, were tested, and it was found that each class has its characteristic properties strongly marked. We will now proceed to the discussion of each particular class.

*Plain Paper.*—In this class 30 specimens were tested. After the resistance at the temperature of the air (22° C.) was carefully noted, the temperature was gradually increased (100° in one-half hour) and readings taken every 10° up to 80° and from there on every 20°. Fig. 2 shows a curve which is characteristic of practically all kinds of plain paper. It should be noticed, however, that in general the resistance of papers that are not protected from moisture falls between 22° and 50° and then rises rapidly until at 75° it has attained a maximum resistance. It should also be noted that this temperature of 75° is very constant for all kinds of paper. From 75° upward the resistance falls rapidly, and at 150° is but a small fraction of its initial resistance.

The initial resistance of paper protected from moisture by japan (Fig. 3) is very high, but falls rapidly with the increase of temperature, as is the case with all material protected from moisture. (See oiled paper and oiled cloth). Hence we see that all paper having a porous structure, and therefore containing more moisture, has a lower initial resistance than the protected paper, but is affected by heat much less than the latter. This would lead to the conclusion that there are two phenomena taking place. First the driving off of the moisture, which tends to increase the resistance, and secondly, some change (not a mechanical deterioration) in the material, dependent on the temperature, and which may be called the temperature coefficient. This temperature coefficient tends to lower the resistance with increase of temperature.

Examining the several curves shown, we see that the initial resistance of unprotected papers is low on account of the presence of moisture. Now, on gradually increasing the temperature, the resistance falls during the first 20° or 30°, because the effect of the temperature coefficient predominates during this period and before the material is warm enough to start the evaporation of the moisture it contains. This, however, lasts but a short time, as the result of the evaporation is to increase the resistance very rapidly, until at 75° the temperature coefficient again asserts itself and the resistance rapidly falls.

In the case of japanned papers (Fig. 3) the initial resistance is very high, due to the absence of moisture, but on being heated the resistance drops rapidly, as the small quantity of water contained is evaporated off so slowly that it has very little counteracting effect on the temperature coefficient.

Paper does not seem to deteriorate mechanically at less than 150°, above this point the material begins to carbonize. At 250° a peculiar phenomenon takes place

1. Read at the general meeting of the American Institute of Electrical Engineers, New York, May 20, 1896.

The material, after possessing a very low resistance from 175° upward, would at about 230° suddenly increase greatly in resistance and immediately after break down. This may be caused by some molecular rearrangement taking place at that temperature which changes the resistance of the material. Other cases wherein the resistance of a body changes at a certain temperature are well known. In the phenomenon of "recalescence" a piece of iron or steel after having been heated to a bright redness and allowed to cool slowly will at a certain stage of the cooling process receive a sudden check. Heat being generated in the metal as a result of the change which the molecular construction suffers at the critical point, the cooling is arrested and the temperature and resistance rise, though the loss by radiation is still going on. The experiments of F. Kohlrausch and Hopkinson have also shown that the critical temperature is marked by a sudden change in the coefficient which expresses the effect of temperature on the electrical resistance of iron. This is also true of nickel. It would seem that paper insulation has a critical temperature somewhat analogous to that of iron, steel and nickel, but of course the characteristics of the materials are too different for any close similarity.

*Plain Cloth.*—Under this head 20 specimens were tested, including canvas, linen and muslin, of different thicknesses. The action of this material (Fig. 4) is much the same as that of paper (Fig. 2). The initial resistance is lower, as it contains more moisture than is the case with paper; for the same reason when the moisture evaporates off, the increase over the initial resistance is greater than with paper. By reference to the curves of paper and cloth it will be noticed that their resistance varies in the same manner. For cloth, as for paper, the maximum resistance is at 75° C. The material does not begin to carbonize until at a temperature of 180° C., and even beyond that point it loses its mechanical strength very slowly until past 220°. The explanation for the resistance of cloth varying as it does is exactly similar to that for paper.

*Oiled Paper.*—In this class 14 tests were made, on papers of different thicknesses. With the single exception of one specimen (the resistance of which was very high) the initial resistance was lower than in the case of paper. (Compare Figs. 2 and 5.) On increasing the temperature the resistance fell rapidly, the curve being much the same as that for japanned paper. The reason for the sudden decrease in resistance is the same as that for japanned paper. Oiled paper deteriorates mechanically at a lower temperature than paper or cloth, commencing to blacken at so low a temperature as 120° C.

*Oiled Cloth.*—In this class 28 specimens of oiled silk, muslin and linen of various thicknesses were tested. The initial resistance of this material is much lower than that of paper, and on increasing the temperature the resistance falls rapidly, the shape of the curve (Fig. 6) corresponding to those of japanned and oiled paper. The reason for the sudden decrease in resistance undoubtedly being the same as for the japanned and oiled paper. The insulation begins to char at about 120° C.

*General Conclusions.*—In the foregoing discussion there are some main points to which it is necessary to draw attention. These are:

(*a*) That paper is a better insulation and withstands increase in temperature much better than cloth (shellac and varnish were not used in any of the experiments), oiled paper or oiled cloth.

(*b*) That paper and cloth have a maximum resistance when first heated at about 75° C. and are not injured mechanically under 180° C.

(*c*) That the point of maximum resistance for paper and cloth (in this case 75° C.) depends on the rapidity with which the temperature is increased. Here the authors would like to suggest that if the material were kept at a constant temperature until all the moisture had been evaporated, the resistance of the material would then be its true resistance at that temperature.

(*d*) That all give a high resistance after cooling, but have little mechanical strength. Oiled paper and oiled cloth, however, after having been heated to 220° C. and allowed to cool, not only have a high resistance, but became so firmly fixed to the brass cylinders that it was found necessary to remove them with a file.

(*e*) That it would be well to bake paper and cloth insulation to 140° C. before applying varnish or shellac.

(*f*) Referring to Fig. 3, it will be seen that on decreasing the temperature the resistance increased, but the second curve does not by any means coincide with the first. On further experimenting in this direction, it was found that there is no temperature at which the curve with falling temperature coincides with the first. This may be due to more moisture being driven out at higher temperatures which is not absorbed by cooling. Here it may be well to mention an interesting phenomenon that occurred in connection with this investigation. When the temperature has risen above 100° C., the zinc in the brass cylinder begins to leave its surface and combine with the copper wire wrapped about the insulation so that the wire has a brass surface and the brass cylinder a copper surface.

Owing to the limited time at the authors' disposal, they were unable to further pursue this investigation, but much remains, and any research along this line will be found full of theoretical as well as practical interest.

EXHIBIT OF THE ROOT BOILER AT THE NATIONAL ELECTRICAL EXPOSITION.

## Electric Motors Supplant Steam Locomotives on the Lake Street "L."

The long contemplated change from steam locomotives to electric motors and electrically transmitted power on the Lake street elevated railroad in Chicago was made on June 14th. The change, which entailed an expenditure of $200,000, will very materially lessen the operating expenses of the road. Fifty firemen were discharged, as their services are no longer needed. The enginemen are retained as motormen at reduced wages. Power is obtained from Mr. Yerkes' power stations for surface roads.

## Exhibit of the Root Boiler at the National Electrical Exposition.

The illustration gives a good view of the exhibit made by the Abendroth & Root Manufacturing company, 28 Cliff street, New York, of its famous improved Root water-tube steam boiler at the recent National Electrical Exposition, New York city. These boilers were selected by a special committee to furnish all the steam used at the exposition, the desire being to install an up-to-date boiler plant. This was the only working boiler plant shown and attracted much attention and favorable comment from visitors, who could not but be impressed with its cleanliness, efficiency and the ease with which it was managed. There were two equal units, forming one battery of 500 horse power. A Wilkinson automatic stoker was used to distribute the coal upon the fire.

The evaporative efficiency ranged from 10 to 11 pounds of water to a pound of coal. The C. W. Hunt noiseless conveyor was used in delivering the coal and taking away the ashes.

So safe and simple was the entire operation of this plant that it was put in charge of Mrs. Frank Walton, a licensed woman engineer, who, as chief engineer, managed the exhibit with rare skill and judgment. The battery of improved Root boilers used at the National Electrical Exposition was an exact duplicate of the six batteries of Root boilers used at the celebrated tunnel plant of the Baltimore & Ohio Railroad company in Baltimore, Md.

## Electrical Equipment of the Fisher Building, Chicago.

The new Fisher building at Dearborn street, Van Buren street and Plymouth place is 18 stories high, and is, with the exception of the Masonic Temple, the tallest building in Chicago. On a pile foundation it is constructed of steel and terra cotta, finished with Italian marbles, mahogany and mosaics. Three Heine water-tube boilers of 450 horse power capacity supply the steam for heating, and six hydraulic elevators are in use.

There is no electric generating plant in the building, but current for about 2,500 incandescent lamps of 16 candle power each is taken from the street mains of the Chicago Edison company. The wiring was very carefully planned. The most distinctive feature of it is that afforded through the wisdom and liberality of the owner in providing sufficient space for electric mains, risers, feeders and cut-out centers upon the various floors. These, instead of being crowded into the same shafts and closets used for gas pipes, gas meters, elevator cables, weights, etc., as is customary in most buildings of the same style, are provided with a separate accessible shaft extending from the bottom to the top of the building, with commodious cabinets on each floor adjoining this shaft for meters and cut-outs. From these cabinets an iron armored conduit of an approved type extends, through the tile partitions or imbedded in concrete floors, to outlets for the connection of fixtures or switches in the different offices.

The general method of construction throughout the building is as follows: Heavy main risers extend in the main shaft from the basement to the top floor of the building, being divided into three sections by two heavy centers of drawn copper bar, mounted upon slate bases, and provided with fuse blocks containing fusible strips, at which points the riser may be cut into three parts in case of trouble. These cut-outs or centers are located upon the fifth and twelfth floors. From each of these centers heavy feeders extend in the main shaft to the basement, and from the foot of this shaft directly to the east curb wall of the building, where they connect with the underground service of the central station company through large service switches of the knife pattern, which combine the functions of service cut-outs and firemen's switches, making it possible to cut off the electric current from the entire building instantaneously. The heavy conductors in the building are of such size and so arranged that either a two or three-wire system of distributing current may be used.

At each floor short sub-mains extend from the main riser in the shaft to tap line cut-outs in the adjoining cutout and meter cabinet. Here a separate cut-out and meter are placed for each office or suite of offices, it being possible with very small expenditure of labor to place a single meter so as to indicate the entire consumption for any combination of offices which the pleasure of the tenants may dictate. From these cut-outs the tap line wires pass through the conduit directly to the fixture outlet. They are of duplex wire, that is, two conductors insulated from each other but contained

within the same outer insulation, and can be readily withdrawn and replaced with new conductors in case of any trouble, without any cutting of plastering.

## Babcock & Wilcox Company at the Exposition.

The exhibit of the Babcock & Wilcox company, maker of forged steel sectional high-pressure boilers, was situated on the ground floor of the electrical exposition and covered a space of 500 square feet. The space was admirably situated for the display of the parts which go to make up this company's well-known steam boilers. The various parts of the sectional water-tube boilers were arranged in such a manner that the visitor was afforded every opportunity for the most critical examination of each individual part. The lighting of the exhibit was a feature that elicited pleasing comment from many of the delegates. A 36 inch steam and water drum was arranged on rolls, which enabled the attendant to so revolve the drum as to bring into view every portion of its construction, in order that the visitor might more minutely examine the design and workmanship. The cylindrical portion of the drum is made of three sheets of open hearth steel. The longitudinal seams are butt-strapped inside and out. All holes are punched five-sixteenths inch smaller than the diameter of the rivets to be used, through steel templates, and drilled out the full size after the sheets are rolled and assembled with the butt-straps in position. After drilling, the straps are removed, all burrs cleaned off and the plates re-assembled, metal to metal, with parallel turned bolts fitting the holes before riveting. Each course is then built independently to template. The various courses and their heads are assembled by an hydraulic for ging press at a pressure of 12 tons. All rivets are driven with a 60-ton pressure and held until cold. The drumheads are fitted with manholes. These heads are forged at a single heat with the extra manhole rings and stiffening plate in position and have flat raised seats for standpipe and feed connections. The edges of the head and manhole faces are machined off true. The manhole fittings are of forged steel. The plate is machined first and turned to a true oval to fit the head. The steam flanges are of forged steel recessed to make a male and female joint, fitted with stud bolts, tapered threads and inside keeper nuts. This standard steam and water drum is tested in the shops, and again when erected on the purchaser's premises, to 300 pounds hydrostatic pressure. The crossboxes into which are expanded the water circulating uptakes are forged from a single sheet of open hearth steel without seams or rivets. The three sections shown, and used as a fence around the exhibit, are built up of four-inch tubes expanded into forged steel headers. These tubes are made of the best knobbled and hammered charcoal iron blooms of standard weight and of such quality that a 1,500 pound hammer dropped five feet onto a tube shall crush the tube without showing cracks or flaws. These sections are subjected to a hydrostatic pressure of 400 pounds after assembling.

The header shown standing upon end is forged from a single sheet of open-hearth steel, serpentine in form, disposing the tubes in a staggered position when assembled in the furnace. The method of expanding the tubes is shown, as also the cap, clamps and handhole fittings. The handholes are of sufficient size to permit the cleaning, removal and renewal of a tube, the handholes being placed opposite the tube ends. The handholes have a raised seat milled off to a true surface and covered on the outside with a forged steel cap (also milled to a true surface) and held in position by a forged steel safety clamp, closing the handhole opening on the inside and secured by a bullhead bolt to secure correct alignment and a forged cap nut. This method of closing handholes is a perfect one mechanically, insuring a tight joint, metal to metal, without packing of any kind.

The company also displayed a line of high-pressure brass steam boiler fittings designed for any pressure demanded. These fittings are the design of the company and are the product of its many years of designing and constructing high-pressure plants. They are now in use on boilers working at 350 pounds pressure. Photographs of many of the large plants installed by the company were shown, and also photographs of its chain-grate automatic stoker. There was also a model of the standard high-pressure sectional boiler. It is perfect in every detail and is capable of generating steam. The boilers built by this company of the forged steel type are said to be the only sectional boilers made of forged metal. They are designed throughout to carry safely a working pressure of 200 pounds per square inch. As is well known, Stephen Wilcox was the inventor of the inclined tube type of water-tube boilers—the type now almost universally used. The Babcock & Wilcox company has on exhibit Mr. Wilcox's original model of his invention made in 1856. This model is historical, though the bent tubes shown were discarded very soon for the straight tubes now used, and the boiler was changed step by step into its present sectional form nearly 30 years ago. Then came the substitution of forgings for castings until the present type was developed. The forgings shown, particularly the serpentine header, are the most difficult and intricate ever attempted and represent the most advanced work yet done in steel forging. The exhibit is shown in the accompanying illustration.

## The Drawbaugh Claims.

The proposed issuance of the Drawbaugh patents by the United States Senate has been surrounded by a good deal of mystery. The published statements indicating that there would be another attempt at monopolizing patents on telephones has drawn forth a strong protest from James E. Keelyn in the form of a letter addressed to Senator Cullom. Mr. Keelyn asserts that he will use every legitimate means and every bit of energy he can command to prevent favorable action by the United States Senate upon what he calls "another outrageous patent iniquity." Mr. Keelyn asserts that the Drawbaugh applications are owned by a syndicate, and that this syndicate proposes to sell to or arrange with the Bell company to operate these patents if granted.

Mr. Keelyn says that the Drawbaugh claims have been rejected by the Patent Office proper upon the ground of previous public use, and that there has been another shrewdly operated plan to force the issue of these patents against the advice of the patent examiners, and, that failing, to lobby Congress to do what otherwise could not be done.

It is further claimed by Mr. Keelyn that the present government suit against the Bell patents would be a simple farce in view of the expiration of the patents, if it were not for the serious fact that the purpose of these suits by arrangement of the Bell company could be of the most dangerous character. These suits by the government allege that the Drawbaugh patents anticipated the Bell patents. Now, if the courts hold this to be the case, the Bell patents would have no effect as anticipated, provided Congress should pass favorably upon the issuance of the Drawbaugh patents.

"Briefly," says Mr. Keelyn, "the Supreme Court will hear the matter October 19th. Even if the Supreme Court does not pass adversely upon the patents, there is no question whatever that they could not be made to estop the use of high-grade telephones as efficient as the Bell company's. Therefore the Bell people are trying in another way to regain their weakened hold upon the telephone business. They feel that their efforts at intimidation and bringing patent suits have failed, and they find that their resort to cutting rates in order to stifle competition has also failed. It is of the highest importance that these Drawbaugh claims be stamped out before they get life enough to be used to intimidate the public, which seems their only purpose, as the Drawbaugh apparatus would be worthless in practice at the present date."

## The Big Cottonwood Transmission Plant at Salt Lake City.

Friends of R. M. Jones, the indefatigable exploiter of the project to electrically transmit to Salt Lake City the power of the Big Cottonwood River from the descent at "The Stairs," will rejoice to know that success has crowned his hard work. The plant was recently inspected by a number of invited guests, including the governor of the state, and the president of the company, Mr. Donnellan, delivered an interesting address, from which the following is taken:

We meet here to-day to witness the finishing touches of one of the most important electric transmission plants in the world. There is but one larger in the United States, namely, the Niagara Falls plant. The one from Folsom to Sacramento, Cal., is equipped with generators of greater capacity than this station, but is using only one-half of its power. In this fire-proof power house we have four 500 kilowatt three-phase generators direct-connected with Pelton water wheels. The potential of the generators will be 525 volts. Step-up transformers are located in the second story of the power house to raise the potential to 10,000 volts for transmission to Salt Lake City, a distance of 13 miles, over the 12 wires you see strung on the poles. The wires are divided into four circuits of three wires each, one circuit for each generator. Step-down transformers are located in the sub-station in the city, near the Knutsford Hotel, to change the potential back to 2,000 volts for distribution throughout the city for general lighting and power purposes. The power generators at the wheel operate under nearly 400 feet head. There being 3,400 cubic feet of water per minute available at the lowest stage, there is nearly 3,000 horse power. The wheels run at 300 revolutions per minute. In addition to this present installation the company owns by purchase the water power of the Granite paper mills, that of the Butler sawmill and the new location above the latter, which it is proposed to unite into one power.

We intend to reconstruct the paper mill for a power house for this plant. It is intended to proceed to the construction of a paper mill power plant immediately, if the means can be found to do so. We also own by purchase the old sawmill location east of this station, known as Mill B, which, together with the location made near the mouth of Mineral Fork, will give us a fall of nearly 1,000 feet. When this present installation is completed we shall have expended about $500,000, and we think we will then have the most economically constructed plant of its capacity in the country. R. M. Jones, who is the originator of the "Stairs" plant, commenced work here on the long tunnel more than four years ago. In the spring of 1893 the Granite paper mills were burned, and the owners, having decided not to rebuild the mills, proposed a consolidation with Mr. Jones, which was effected in the organization of the Big Cottonwood Power company, with myself as president, George M. Cannon secretary, R. M. Jones manager and director, Joseph W. Summerhays as chairman of the executive committee of the board of directors, and George M. Downey as treasurer, and W. H. Rowe director. I have known Mr. Jones for many years. He was designer, builder and electrician of one of the first incandescent lighting plants in the United States, which was built in Laramie, Wyo., 10 years ago. I was the treasurer of the company and found the capital for it. This station was an electrical and financial success from the start; it paid handsome dividends from the beginning, and is still paying dividends. You will see that I was not a stranger to Mr. Jones' ability. He has staked his all in this enterprise. He has put every dollar he had into it, as well as all he could borrow, and I know that he has many times during the hard years through which we have recently passed suffered the pangs and pinches of most adverse fortune.

BABCOCK & WILCOX COMPANY AT THE EXPOSITION.

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EVERY SATURDAY.

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**SUBSCRIPTION,** in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

**ADVERTISING.**—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own.* THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring modern trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK
CIRCULATION, 16,630.

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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* 3,687 and the *Electrical Review* 3,375 square inches of advertising.

The WESTERN ELECTRICIAN'S advertising, therefore, exceeded that of the *Electrical World* by **250** inches, that of the *Engineer* by **3,889** inches and that of the *Review* by **4,201** inches. It exceeded the combined advertising of the *Review* and *Engineer* by **514** inches.

The steady advancement of special convention advertising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

| Issue. | Number of Advertising Pages. | Total Number of Pages. | Square Inches of Paid Advertising Matter. |
|---|---|---|---|
| March 3, 1894.... | 40 | 56 | 4,145 |
| February 23, 1895. | 52 | 68 | 5,593 |
| May 9, 1896..... | 72 | 88 | 7,576 |

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

IT has become a fad to have entertainments and conventions as well as exhibitions in which electrical features are prominent opened with some sort of an electrical display. For instance, last week President Cleveland at Washington formally opened the national sængerfest at Pittsburg, Pa., by pressing an electric button in the executive mansion and closing an electric circuit, the immediate effect of which was to illuminate in the hall in which the sængerfest was held an immense American flag formed of hundreds of beautifully colored incandescent lights. Before touching the button the president sent a telegram to the chairman of the committee of arrangements of the sængerfest. The message was read to the assembled throng in Exposition hall and then, when the operator at the other end made the signal "O. K.," the president touched the button. Subsequently word was received at Washington that the opening was a great success and that great enthusiasm prevailed among the 8,000 persons assembled in the hall.

ONE need not subscribe to all the articles of faith accepted by the believers in postal telegraphy in order to understand some of the arguments advanced in favor of the government absorbing the telegraph and telephone business. It is pointed out that many of the most important improvements now in use have been forced upon the companies. On this point P. B. Delany said recently, in an argument before the Senate committee:

It is significant that none of the improved methods of telegraphy now in use originated within the controlling telegraph organization, all having come to it by purchase of competing lines, or from individuals outside. The well-known Page patent was the work of an examiner in the Patent Office. Stearns was connected with the municipal telegraph of Boston when he brought out his duplex system, and it required two or three years' effective work by a competing line to gain a foothold for it. Edison's quadruplex system was an outside creation. The telephone was a foundling left on the doorstep of the leading telegraph company, but was not adopted, and was recognized only after it had grown into great promise.

It is also a fact that the existing companies have not availed themselves of the advantages offered in the adoption of many of Mr. Delany's ideas and devices. Possibly the government might pursue a different policy.

MILWAUKEE has gained considerable prominence of late on account of the street railway strike in that city. The results of that controversy are far-reaching and important, and now seem destined to exert an influence upon national politics. It will be remembered that the leaders of the Republican party in Wisconsin vainly attempted to effect a settlement of the trouble shortly after the strike was declared, fearing the influence of the disagreement between the men and the officers of the company, who were prominent in the party councils. Now, the labor leaders have transferred their warfare to St. Louis and, according to our Milwaukee correspondent, they will endeavor to have Colonel Payne dropped from the national committee. The Wisconsin delegation, it is reported, will also oppose Payne, but it is asserted that his influence will prove too strong for the opposition to overcome. The Milwaukee railroad magnate has been a power in politics in Wisconsin as well as in financial and commercial circles, and he will not give up his leadership without a desperate struggle, it is believed. That he is resourceful and energetic is well understood by those who are fighting him, and his determination to remain master is shown by the manner in which he has conducted the company's campaign against organized labor during the last two months. It looks now as if the strikers were beaten, as many have already applied to the company for work; and the worst feature of the trouble is that there are at present no places for the old men. It is true the company is losing money, but it is probable the corporation can stand it better than the strikers, many of whom have long since exhausted their savings and are now depending upon their associates and friends for the support of their families.

NEXT month there will be many more electrical engineers in this country than at the present time; that is, there will be more young men to whose names will be added the "E. E." that carries with it so much dignity and authority in the minds of these enthusiasts. Probably these young men will lose some of their enthusiasm in the course of a few years and then they may not employ initials before and after, but while the enchantment lasts they will value this title as they do their personal reputations. Nor would we have it otherwise. It is well that there is a little enthusiasm injected into this prosaic old world by these young men fresh from their books and class-rooms; otherwise life would become insufferably monotonous. Some of this year's aspirants for fame and fortune may win distinction, others may become discouraged and give up the fight, but in any event we feel that the world will be better for their efforts and that they are deserving of encouragement and assistance. Many of the most successful men in the electrical field have not had the advantage of college education, it is true, and this fact is often advanced as an argument by those who place little value upon technical education, but it should have little weight, for the reason that many more men have been assisted to prominence in the profession by the college training received in their early days. It is undoubtedly true that the so-called "practical men," who gained their knowledge only at such a great price, might have been far more successful and might have contributed much more to the science and the art had they enjoyed the advantages that are now at the disposal of those who desire a thorough training in electrical engineering.

IN a number of cases it has been held by the Supreme Court of Illinois that it is negligence for a passenger to get off a moving train of which the motive power is steam, while the cars are in motion, and this seems to be the general rule in most, if not all, of the states. But the Supreme Court of Illinois now says that it is relaxed when applied to horse cars or street railways, and that the doctrine is established in nearly all of the states where the question has arisen that it is not negligence in itself for a passenger to board or alight from a street car operated by horse power, and the question of contributory negligence is one of fact, for the jury, to be determined by the particular circumstances in each case. Where the motive power is electricity, it goes on to say, as in the case of the Cicero & Proviso Street Railway company against Meixner (43 N. E. Rep., 823), a question not entirely free from difficulty is presented. But the purpose to which a power of this character is applied must to some extent be considered. Where horses were formerly used, electricity has now in a great measure superseded. The same style and often the same cars are used; the same streets are traveled, and a like number of stops, and in like places, are made, to receive and deliver passengers. Electricity as a motive power, while stronger and more powerful and with possibilities of a greater speed, is at the same time more nearly under the control of the person in charge than horse power. The strict rule in force regarding the negligence of a person alighting or boarding an ordinary train of steam cars had for it many good and sufficient reasons, which are not applicable to the electric car, as in general use. In the latter case, stops are frequent, and opportunity for great speed is not presented. Steps for passengers are near the ground, and the chances of a misstep, or fall, are not so great as in steam cars, with present construction. Streets on such lines are generally paved, and in that respect passengers may as safely depart or board such cars in one place as another, whereas, in the case of steam cars, platforms are generally provided. Such is the reasoning of the court, upon which it rests the conclusion that while in electric cars the possibilities of speed are greater than in the case of horse cars, yet the general operation and management of such cars so nearly approaches to that of horse cars that it must be held that the same rule of law which, in a long line of cases, holds that it is not negligence in itself to board or depart from such cars while in motion, is also applicable to electric cars.

## Data on Operation of Central Station Plants.[1]

By H. M. Sweetland.

Your committee is able to present a tabulated statement of watt-hours produced per pound of coal from 82 central stations using coal as fuel, and from one using crude oil, and is able to show the class of equipment from all, boiler tests from 32 and engine efficiency from eight.[2] So far the work has been carried forward on the lines of the previous reports by this committee. In addition to this, we have been able, from the information furnished, to construct load lines from 22 of the stations reported, the lines being presented on charts 1, 2 and 3, submitted herewith, each line being numbered to correspond with the number of the report. Economies are given from a number of the largest electric stations in the country, five of them having an output of over 10,000,000 watt-hours per day, and 45 having an output of one to 10 million watt-hours per day. Four of the large stations represent a production of 94,270 kilowatt-hours and a consumption of 524,067 pounds of coal or 179 watt hours per pound of coal. The aggregate output of these 49 large stations reaches the production of 212,617 kilowatt-hours in one day at an expense of 1,316,703 pounds of coal, or an average of 161 watts per pound of coal. The aggregate output of 32 smaller stations, those producing less than 1,000,000 watt-hours per day, represents a production of 11,973 kilowatt-hours with an expenditure of 194,274 pounds of coal, or 62 watts per pound of coal. The aggregate electrical output of entire report, several stations having reported for a long period, in one case (report 6) for one year, represents the generation of 4,618,976 kilowatt-hours at an expense of 28,274,536 pounds of coal, or an average of 163 watt-hours per pound of coal. The average efficiency of the 81 reports using coal as fuel is 108 watt-hours per pound of coal; one report giving the production from crude oil shows 1,717 watt-hours per gallon of oil.

The load lines shown in the charts have been constructed from 30-minute readings from meters or estimated from voltage and amperes. The committee realizes that in the case of alternating currents the product of amperes times volts may not give the absolute watts, but this method has been considered sufficiently accurate for this work, and has been used in a few instances. The minor points called for in the information blank sent out by the committee relative to evaporation per pound of coal, water used in the engines, calorimeter tests, etc., have not received very general attention, although simple directions were given for this work. The 31 stations reporting the water evaporated per pound of coal show a wide range of boiler efficiency not to be accounted for by the difference in quality of fuel. Report No. 81 evaporates 10.5 pounds of water per pound of semi-bituminous coal, comparing favorably with report No. 8, each using horizontal tubular boilers; while report 67 evaporates only 4.66 pounds of water per pound of bituminous coal with the same style of boilers. The average evaporation per pound of coal from all stations giving reports is 7.09. In engine efficiency eight stations report the water consumption per indicated

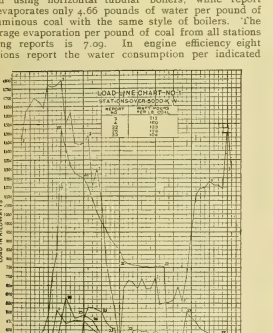



FIG. 1. DATA ON OPERATION OF CENTRAL STATION PLANTS.

horse power. The triple expansions lead in economy, report 80 showing a consumption of 15½ half pounds, and report 3 showing 18 pounds of water per indicated horse power. These compare reasonably with report 29, where an indicated horse power is produced by non-condensing engines with 26 pounds of water. Report No. 22 in the table of economies, submitted at the last convention, showing a production of 262 watts per pound of coal, and having the highest economy in the stations mentioned in that report, is from the same station as report No. 3 in the present table, and which in point of economy stands third on the list, the economy being 212 watts per pound of coal, a showing somewhat inferior to the previous report. The station is reported in a general way as running at greater economy than when the previous report was made. The efficiency figures, however, would seem to contradict this statement and to verify the statement in the present report. In the previous report, 9.37 pounds of water was evaporated per pound of combustible, and 1.7 pounds of water consumed in the engines per horse power. The present report brings the evaporation per pound of combustible down to 8.81 pounds of water, and the steam consumption in the engines is raised to 18 pounds, which would account for the lower efficiency stated in the present report.

Attention is called to the reports from plants running with non-condensing engines, in which report 26 (see load line) is able to show 129 watt-hours per pound of coal; report 32 (see load line) 113 watt-hours; report 33,

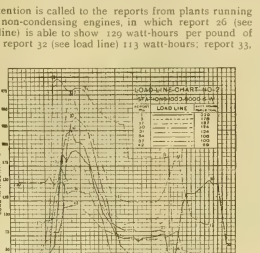



FIG. 2. DATA ON OPERATION OF CENTRAL STATION PLANTS.

109 watt-hours; report 37 (see load line) 100 watt-hours; and report 38, 95 watt-hours. While Nos. 39 (see load line) 43, 59 (see load line), 68 and 71 running condensing produce respectively only 94, 68, 33, 78, and 87 watt-hours; this showing and other features of the report proving conclusively that it is as much a question of management and manipulation as of the type of machinery used.

In conclusion we are led to repeat a former statement by this committee that the economy secured in generating power for electrical work does not compare favorably with the production of power for other purposes, and that this is also true after taking into consideration the variation in load due to electrical work. Referring to a recent statement of the economy of the Chestnut Hill pumping station at Boston, it was found that in actual water lifted a horse power was produced by the consumption of 1.34 pounds of coal; allowing that the efficiency of pumps compares favorably with efficiency of the generators, and making no allowance for variation in load, one pound of anthracite coal used with the same economy in electrical work should produce 557 watt-hours. Our load line charts show a fair average of the variation in electrical work, chart 1, chart 2, from 2,000 to 4,000 kilowatts at 6 P. M. to 250 kilowatts at midnight; yet the changes seem, as generally true in electrical lighting, to be fairly uniform, and a station planned with the proper units for the work should operate the much larger percentage of its generating appliances on a fair basis of economy, bringing the record in this work much nearer the standards of efficiency in other lines. We advise more careful records, more frequent tests of all apparatus and a steady application of principles of economy until this record can be made to show more favorable comparison.

## The Telegraph at St. Louis.

[From the Rochester *Post-Express*.]

Very few readers of the newspapers, which the telegraph serves, can realize the enormous work that it does on great occasions, like that at St. Louis. The best sending talent has been summoned to the convention city operators who can transmit from 50 to 60 words a minute, and from 500,000 to 750,000 words will be sent out each day. Many miles of new wire have been strung and new loops and instruments placed in position. A special wire will connect the convention with the modest home in Canton, where its master, confident, yet serene, will talk with his representatives on the ground as freely, as easily, and as confidently, as though they were face to face. All special wires have already been run to the great newspaper establishments of the land, wherein the pen will respond to the electric current, and editorial opinion have instant expression with convention action. One hundred and fifty sounders and keys will be mounted, each instrument demanding a separate apartment, as well as separate wires from the switchboard. The offices in the convention will be directly under the speaker's stand, and pneumatic tubes will run from the space above to the operators below. In this way, a special correspondent sitting at a table in front of the chairman, can have an assistant sort his copy, dump it into a pneumatic carriage, and it will bob up at once at the operator's right arm No time will be lost in counting words, as they will be attended to afterward, the operators retaining the copy, and sending it to the main office for checking off. Perfect mechanical appliances will be the servitors of the mighty force which Franklin brought to the earth and Morse harnessed for the use of man.

## Milwaukee Street Railway Troubles.

Special telegram to the Western Electrician.

Milwaukee, Wis., June 13.—There has been little change in the street railway strike during the present week. A number of the strikers, perhaps a hundred, have applied for reinstatement, but as the company has had a full force for several weeks, most of them will have to wait a while before being put back to work. The strikers have appointed commissioners to visit other cities in the country and solicit financial aid. W. D. Mahon, the national president of the order, left early in the week for Chicago and Toledo, but is expected back to-day. There is some talk again of a sympathetic strike, and it is said that the matter will come up at a meeting of the Federated Trades Council this evening. The strikers will send a committee to the Republican national convention at St. Louis to protest against the reappointment of Henry C. Payne, vice-president of the street railway company, as national committeeman for Wisconsin. The Milwaukee delegates will oppose the reappointment of Mr. Payne on account of the feeling against him in labor circles, but he will probably continue to serve upon the national committee just the same.

The strikers declare that there is not the slightest intention of declaring the strike off. "So long as there are 15 of us left for a quorum," said one of them yesterday, "there will be no such declaration. We will fight to the end. The company is experiencing enormous losses. Every trades union in the city is boycotting it and it simply cannot hold out much longer." On the other hand, the company reports that its business is steadily increasing, and that so far as it is concerned the trouble is virtually ended.

## Telephone News from the Northwest.

[From the Minneapolis correspondent of the Western Electrician.]

The Northwestern Telephone Exchange company is securing a right of way from Jordan, Minn., to Albert Lea, Minn., for its long-distance line to Sioux Falls, S. D., from the Twin Cities.

Arcadia, Wis., capitalists have purchased the telephone lines owned by C. S. Utter of Trempealeau, Wis., running from Centerville to Arcadia. The line will be extended to Independence, Whitehall, Blair, Waumandee and Montana, and from Centerville to Bluff Siding, near Winona, Minn., where connection with the Winona Telephone company will be made. A line from Trempealeau to Lytles is contemplated to connect with the La Crosse Telephone company.

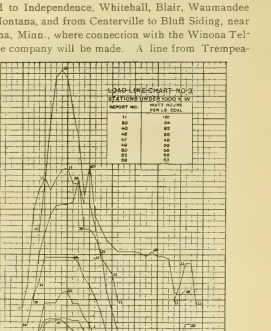



FIG. 3. DATA ON OPERATION OF CENTRAL STATION PLANTS.

It is reported that a combination is proposed between all the independent telephone companies in Wisconsin and the Postal Telegraph company, as the Western Union refuses to have other than Bell instruments in its offices.

The contract has been let for the construction of a telephone line from Olivia, Minn., to Renville.

C. W. Rickerd, who secured a telephone franchise at New Richmond, Wis., is to have the exchange in operation by November 1st.

The Home Telephone company of Sioux City, Iowa,

1. Report of committee on data. National Electric Light association, New York, May 6, 1896.
2. Table, page 308.

is canvassing St. Paul with a view to establishing a co-operative exchange there.

The Home Telephone company of Sioux City, Iowa, is arranging for extending its line to South Sioux City, Dakota City, Jackson, Ponca and New Castle, Neb. Another line will be built to Homer, Emerson, Wakefield, Wayne, Hartington, Concord and Laurel—in all about 148 miles.

The local telephone line at Jefferson, Iowa, has passed into the hands of capitalists who propose to extend it to Herndon, Jamaica and Perry and thus connect with Des Moines, and on the east with Boone, via Ogden and Grand Junction, and on the north with Fort Dodge.

TABULATED REPORT FROM ELECTRIC LIGHT STATIONS; SHOWING WATTS PER POUND OF FUEL, EQUIPMENT, EFFICIENCY, ETC.

| No. of Report. | Hours in Run. | Watt Hours, One Day. | Coal Used, One Day. Lbs. | Watt Hours Per Lb. Coal. | Fuel—Kind and Grade. | Equipment. (See Foot Notes.) Engines. | Boilers. | Dynamos | Boiler Test. Evaporation Per lb. Coal. | Per lb. Combustible. Actual. | From and at 212° | Engine Test. Water per hour per I.H.P. | No. of Report. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 24 | 3207392 | 11600 | 237 | Bit. Lump. | D | C | V | 6.2 | 6.87 | 7.12 | — | 1 |
| 2 | 24 | 2397712 | 11251 | 213 | Bit. Lump. [Screenings. | D | C | V | 5.7 | 6.45 | 6.69 | — | 2 |
| 3[1] | 24 | 26402256 | 124383 | 212 | ½ Ea. Soft Coal and Hard | A | A | A | 7.38 | 8.81 | 10.22 | 18. | 3[1] |
| 4[1] | 24 | 5053166 | 28050 | 180 | ½ Anth. ½ Pea and Dust. | B | 1A, 5C | B | 8.91 | — | — | 36.9 | 4[1] |
| 5[2] | 24 | 1818780 | 10200 | 178 | .4 Coke .6 Coal. | CD | C | V | 5.4 | 5.75 | 6.41 | 27.6 | 5[2] |
| 6 | 24 | 11488509 | 65884 | 174[4] | Bit. Run of mine. | BDz | C | V | — | — | — | — | 6 |
| 7 | 24 | 1212900 | 7105 | 171 | " " " | B | C | V | — | — | — | — | 7 |
| 8 | 24 | 825000 | 5022 | 164 | Bit. and Hard Screenings. | Ex | C | V | 10.35 | 11.48 | — | — | 8 |
| 9 | 24 | 4270077 | 26600 | 161 | ½ Anth. ½ Dust and Pea. | B | 1A, 5C | V | 9.17 | — | — | 42.2 | 9 |
| 10 | 14 | 1718000 | 11400 | 151 | Bit. Va. | BC | C | V | — | — | — | — | 10 |
| 11[3] | 15½ | 8600 | 5500 | 151 | " " | CD | A | Alt. | — | — | — | — | 11[3] |
| 12 | 24 | 2156000 | 14493 | 149 | Buckwheat. | 3C, 1E | C | Alt. | 8.99 | 10.34 | 11.23 | — | 12 |
| 13 | 14 | 1625000 | 11440 | 142 | Bit. | BC | C | V | — | — | — | — | 13 |
| 14 | 16½ | 711720 | 5100 | 140 | Bit. Slack. | D | C | V | — | — | — | — | 14 |
| 15 | 16½ | 727720 | 5200 | 140 | Bit. | D | C | V | — | — | — | — | 15 |
| 16 | 14 | 1624000 | 11840 | 137 | Bit. Run of mine. | BC | C | V | — | — | — | — | 16 |
| 17[2] | 14 | 2734976 | 19900 | 137 | Slack. | Dx | B | V | 8.25 | 8.9 | 9.43 | — | 17[2] |
| 18 | 14 | 2599705 | 19050 | 136 | Slack. | Dx | B | V | 7.92 | 9.35 | 9.9 | — | 18 |
| 19 | 14 | 1526000 | 11200 | 136 | Bit. Run of mine. | BC | C | V | — | — | — | — | 19 |
| 20 | 14 | 1560000 | 11600 | 134 | " " " | BC | C | V | — | — | — | — | 20 |
| 21 | 14 | 2722463 | 20650 | 134 | Slack. | Dx | B | V | 7.8 | 8.8 | 9.39 | — | 21 |
| 22[1] | 24 | 16149010 | 121400 | 133 | Slack and Bit. | B | C | V | — | — | — | — | 22[1] |
| 23 | 16 | 1528100 | 11595 | 131 | Bit. Lump. | D | C | V | — | — | — | — | 23 |
| 24 | 15½ | 695720 | 5300 | 131 | Bit. | D | C | V | — | — | — | — | 24 |
| 25 | 16 | 1549100 | 11860 | 131 | Bit. Run of mine. | B | C | V | 7.7 | 8.3 | — | — | 25 |
| 26[1] | 24 | 5401900 | 41924 | 129 | Semi-Bit. | EDx | BC | .. | 9.5 | 12.2 | — | 30 | 26[1] |
| 27 | 14 | 1399000 | 11200 | 126 | Bit. | BC | C | V | — | — | — | — | 27 |
| 28 | 16 | 1568600 | 12000 | 131 | Bit. Lump. | B | C | V | 7.7 | 8.3 | — | — | 28 |
| 29 | 13 | 2103800 | 16800 | 125 | Anth. Buckwheat. | Cx | C | C | 6.84 | 8.26 | 8.73 | 26 | 29 |
| 30[2] | 24 | 2683008 | 21571 | 124 | Bit. Nut and Slack. | Ex | AC | Bi.P. | — | — | — | — | 30[2] |
| 31[2] | 17½ | 3396619 | 27414 | 124 | .................. | — | — | — | 9.8 | 9.8 | — | — | 31[2] |
| 32[2] | 24 | 1763795 | 15625 | 113 | ½ Ea. Bit. and Anth. | EDx | C | B | 8.93 | 10.57 | 11.02 | — | 32[2] |
| 33[1] | 24 | 6794304 | 62504 | 109 | .6 Anth. 4 Bit. | Ex | 6C, 5A | BE | — | — | — | — | 33[1] |
| 34[2] | 24 | 1193876 | 10475 | 106 | Anth. Buckwheat. | 4C, 1E | C | C | — | — | — | — | 34[2] |
| 35 | 24 | 1074436 | 10250 | 105 | " - " | 4C, 1E | C | C | — | — | — | — | 35 |
| 36 | — | 160049988[5] | 1533000 | 104 | Bit. Screenings. | BC | AB | — | — | — | — | — | 36 |
| 37[2] | 12½ | 2202363 | 22080 | 100 | Lignite, Run of mine. | BDx | AC | Alt. | 4.8 | 5.2 | — | — | 37[2] |
| 38 | — | 288440 | 3041 | 95 | Bit. " " | Ex | C | C | — | — | — | -- | 38 |
| 39[3] | 9½ | 454058 | 4831 | 94 | Slack. | D | A | V | — | — | — | — | 39[3] |
| 40[3] | 13 | 903720 | 9812 | 92 | Bellwood Bit. | BDx | A | — | 5.1 | 5.6 | 5.93 | — | 40[3] |
| 41 | — | 268800 | 2896 | 92 | " " | Ex | C | C | — | — | — | — | 41 |
| 42[2] | 24 | 1444931 | 20800 | 69 | Slack. | Ex | BC | BC | 6.33 | — | — | — | 42[2] |
| 43 | 6½ | 93541 | 1365 | 68 | Buckwheat, Anth. | E | C | C | — | — | — | — | 43 |
| 44 | 8 | 230187 | 3600 | 64 | .................. | Ex | C | B | — | — | — | — | 44 |
| 45 | 14¾ | 310928 | 5000 | 62 | Bit. | Ex | C | V | — | — | — | — | 45 |
| 46[3] | 15 | 254745 | 4520 | 56 | Bit. | Dx | C | C | — | — | — | — | 46[3] |
| 47[3] | 7½ | 186412 | 3810 | 49 | Slack. | Ex | C | B | — | — | — | — | 47[3] |
| 48 | 24 | 66285375[6] | 1160500 | 57 | Bit. | 1D, 2Ex | A | C | — | — | — | — | 48 |
| 49[3] | 14 | 156800 | 2800 | 56 | Bit. Run of mine. | Ex | C | C | — | — | — | — | 49[3] |
| 50[3] | 7½ | 214485 | 3900 | 56 | Bit. | Ex | C | B | — | — | — | — | 50[3] |
| 51 | 7½ | 204435 | 3600 | 57 | Bit. | Ex | C | B | — | — | — | — | 51 |
| 52[3] | 10 | 6453491[5] | 116000 | 56 | Bit. and Slack. | Cx | C | Alt. | — | — | — | — | 52[3] |
| 53 | 7½ | 217228 | 4000 | 54 | Bit. | Ex | C | B | — | — | — | — | 53 |
| 54 | 7 | 221250 | 4200 | 53 | " | Ex | C | B | — | — | — | — | 54 |
| 55 | 7½ | 186412 | 3810 | 49 | Slack. | Ex | C | B | — | — | — | — | 55 |
| 56 | 7 | 208535 | 3900 | 53 | Bit. | Ex | C | B | — | — | — | — | 56 |
| 57 | 6 | 161458 | 3150 | 51 | Bit. | Ex | C | B | — | — | — | — | 57 |
| 58 | 7½ | 174928 | 3720 | 47 | Bit. | Ex | C | B | — | — | — | — | 58 |
| 59[3] | 15 | 203555 | 6200 | 33 | Anth. Buckwheat. | Ex | C | V | — | — | — | — | 59[3] |
| 60 | 14 | 762825 | 20700 | 37 | Bit. Slack. | Exy | C | V | 5.44 | — | — | — | 60 |
| 61 | 15½ | 806880 | 19300 | 42 | " " | Exy | C | V | 5.78 | — | — | — | 61 |
| 62 | 18 | 1294708 | 31040 | 42 | " " | Ex | C | V | 4.23 | — | — | — | 62 |
| 63 | 16½ | 866235 | 20500 | 42 | " " | Exy | C | V | 5.75 | — | — | — | 63 |
| 64 | 14 | 1454656 | 31739 | 46 | Bit. No. 2 Nut. | Cx | B | V | 5.48 | 6.5 | 6.85 | — | 64 |
| 65 | 14½ | 1881102 | 31992 | 59 | " " | Cx | B | V | 5.8 | 7.1 | 7.48 | — | 65 |
| 66 | 24 | 194472 | 3300 | 65 | Wilmington Lump. | (IE, 7C) x | C | C | — | — | — | — | 66 |
| 67 | 8 | 444133 | 6101 | 73 | Bit. Slack. | Ex | C | V | 4.66 | — | — | — | 67 |
| 68 | 14 | 1201483 | 15386 | 78 | Bit. | C | C | Alt. | — | — | — | — | 68 |
| 69 | 10 | 506697 | 6296 | 80 | Bit. Slack. | Ex | C | V | 5.59 | — | — | — | 69 |
| 70 | 24 | 5982000 | 71000 | 84 | Bit. Screenings. | (6D1E5Dz)x | A | V | — | — | — | — | 70 |
| 71 | 14½ | 1243441 | 14224 | 87 | Bit. | C | C | Alt. | — | — | — | — | 71 |
| 72 | 14 | 477425 | 5400 | 88 | Semi-Bit. | Ex | C | Alt. | 9.68 | 10.7 | 11.13 | 37 | 72 |
| 73 | 24 | 2879000 | 31200 | 92 | Bit. Screenings. | Dxz | A | A | — | — | — | — | 73 |
| 74 | 13½ | 1217000 | 12895 | 94 | Anth. | Ex | C | V | — | — | — | — | 74 |
| 75 | 24 | 1960973 | 17600 | 111 | Bit. | Ex | C | V | — | — | — | — | 75 |
| 76 | 24 | 3366065 | 20300 | 166 | ½ Ea. Anth. Bit. | B | A | Alt. | 6.82 | 7.89 | 9.20 | — | 76 |
| 77 | 24 | 3373305 | 20300 | 166 | " " | B | A | Alt. | 6.2 | 7.14 | 8.33 | — | 77 |
| 78 | 24 | 3398595 | 20300 | 167 | " " | B | A | Alt. | 6.6 | 7.56 | 8.82 | — | 78 |
| 79 | 24 | 40230300 | 213000 | 189 | Bit. Screenings. | A | A | A | — | — | — | 15½ | 79 |
| 80 | 24 | 14941089 | 8700 gals | 1717[6] | Crude Petroleum. | D | 2B, 1C. | B | — | — | — | — | 80 |
| 81 | 24 | 3455988 | 19100 | 181 | Semi-Bit. | (A.D.E)xy | C | V | 10.5 | — | — | — | 81 |
| 82 | 24 | 5761915 | 40800 | 141 | 3 Slack 1 Nut. | 1D, 2B | B | V | — | — | — | — | 82 |

NOTES. [1], [2], [3]; See Load Line Chart [1], [2] or [3], the load line bearing same number as report.
[4]; Average from one years' record.
[5]; Total for one month.
[6]; Per gallon of oil.

Equipment Letters denote classes as follows:
A. Engines, triple expansion condensing. Boilers, horizontal water tube. Dynamos, multipolar on engine shaft.
B. Engines, Corliss compound condensing. Boilers, vertical water tube. Dynamos, bipolar, belted from jack shaft.
C. Engines, simple Corliss, or slow speed condensing. Boilers, horizontal tubular. Dynamos, continuous current.
D. Engines, high speed compound condensing, belted direct to dynamo.
E. Engines, simple high speed condensing, belted direct to dynamo
x. Any of the above non-condensing.
y. Belted to dynamos.
z. Dynamo on engine shaft.

DATA ON OPERATION OF CENTRAL STATION PLANTS.

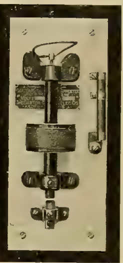


Fig. 1.

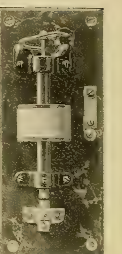


Fig. 2.

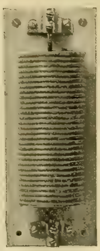


Fig. 3.

IMPROVED GARTON LIGHTNING ARRESTERS.

## Improved Garton Lightning Arresters.

Several types of the improved Garton lightning arresters are herewith illustrated. The demand for these devices from leading railway and lighting stations, as well as from electrical manufacturers, shows that they have real merit. Such is the pressure of orders that the manufacturer—the Garton-Daniels Electric company of Keokuk, Iowa—has been obliged to double its force, but it is now in a position to promise the shipment of goods ordered on the day after the receipt of the order at the latest.

Fig. 1 shows the street railway station type on base of white Italian marble (size five by 12 inches). This arrester has been recently adopted for several of the large electric railways in Chicago and St. Louis, after exacting competitive tests. It take less than one ampere at 500 volts on short-circuit—a merit that will be appreciated by every manager.

The type of arrester designed for lighting stations (shown on marbleized slate base in Fig. 2) is of the same general design as the railway type, and is made for use on 52 and 104 volt secondary, 110 and 220 volt Edison three-wire, 500 volt power, 1,000 and 2,000 volt primary, two and three-phase alternating and arc circuits of any voltage. At the moment of discharge this arrester does not cause a fall of potential and consequent dimming of the lights. This is an obvious advantage.

For stationary motor protection, Garton lightning arresters are especially recommended. When properly installed they have, it is claimed, always given the highest satisfaction. One arrester should be placed on each wire entering the building. By placing a "kicking coil" (shown on slate base in Fig. 3) in each side of the circuit between the arresters and the apparatus to be protected, an inductive resistance is interposed that causes the discharge to go to ground through the arrester. These coils are highly recommended, especially for street railway motors.

Pole arresters and arresters for use on electric cars are also supplied. All types are asserted to be unsurpassed for positive action, reliability, durability and efficiency.

## Electricity on an Ohio River Steamboat.

The most recent addition to the fleet of steamboats plying on the Ohio is the Virginia of the Pittsburg and Cincinnati line, launched last November, from the ways of the Cincinnati Marine Railway company. She is of the flat-bottomed stern wheel type (Fig. 1), 235 feet long, 40 feet beam and seven feet depth of hold in the clear. The cabin is full length and is 190 feet long, with 50 staterooms opening upon it. The texas is 100 feet long. The decorations of the cabin are in lincrusta walton, the color plan being blue, white and gold.

The machinery consists of a double set of tandem compound condensing engines with high-pressure cylinders of 15 inches diameter, low-pressure of 33¼ inches diameter and 84 inch stroke. Steam at 186 pounds is supplied by one battery of four externally fired steel boilers, 42 inches in diameter and 20 feet long. The Virginia is lighted by electricity throughout, the Gen-

eral Electric company furnishing the entire equipment

The generator is a 25 kilowatt multipolar machine directly connected to a 30 horse power automatic engine. The plant (Fig. 2) is set up on the lower deck, in the main engine room, and furnishes current for 250 incandescent lamps, two arc lamps and one searchlight. One hundred incandescent lamps are used in the main cabin, one in each stateroom, and 100 more in the texas and elsewhere. The searchlight is one of the regular General Electric 12 inch projectors, fixed to the crane mast forward and controlled from the pilot house. The switchboard is of the skeleton type and carries a voltmeter and ammeter, rheostat and switches controlling seven circuits. Each switch and junction box located at different points in the vessel is of the General Electric marine watertight type and everything has been done to make the installation perfect.

The Virginia now plies regularly between Cincinnati and Pittsburg, and is claimed to be the handsomest and most perfectly equipped boat ever seen on the Ohio River

## Gardner Double Disk Grinder.

The Gardner grinder, made by Charles H. Besly & Co., 10 and 12 North Canal street, Chicago, is now being made with the two disks close together and parallel with each other, as shown in the illustration. This new form of the Gardner grinder is adapted to grinding two faces which are opposite and parallel to each other, such as square-headed screws, washers, spanner wrenches, etc. The work to be ground is placed between the disk wheels, one of which is movable. The work is held on a rest which is between the wheels. The movable wheel is then brought up, grinding the side next to it, and also pressing the piece to be ground against the other wheel, which grinds the opposite face.

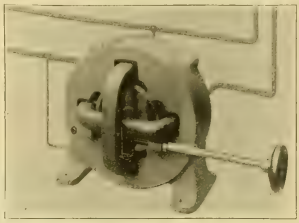
The disk wheels are made from steel and are ground flat. It is said that work can be ground true on the Gardner grinder to the ten-thousandth part of an inch. The cutting faces of the wheels are emory paper or cloth, which are glued on the steel disks, and securely held in place by the spiral grooves on each face of the disk. The cutting surface of the emery cloth sinks into the spiral groove, thus forming a clearance for the particles of emery and iron to fall in, so that these particles do not roll between the cutting face and the work and prevent the wheel from cutting. This feature makes the Gardner grinder a faster cutter than any other grinder, and it will do from two to 10 times the work of a solid wheel in the same time. With the parallel disks as many as 800 square-head set screws can be ground in an hour, grinding the four sides of each head and making the opposite sides parallel.



NEW BLISS CIRCLE SHEARS

## New Bliss Circle Shears.

The accompanying illustration shows the new model of Bliss shears for cutting circles of sheet metal in large sizes. This and a smaller machine are designed especially for cutting armature core disks, and for that purpose accompany the Bliss armature disk notching presses (described and illustrated in the WESTERN ELECTRICIAN of April 25, 1896), where the output is not great enough to justify the use of large presses and ring-cutting dies. In this work they are used for cutting both the outside and inside of the plain rings, the angular position of the lower cutter giving as clean a cut on the inside as on the outside of the disk. They are equally useful for any other work requiring circular disks of sheet metal, especially where large circles of various diameters are used, but not in sufficient quantities to render economical the use of cutting dies and presses suitable for their operation. The smaller machine, known as No. 10½, weighs 750 pounds. It will cut circles ranging in diameter from four inches to 40 inches from metal not exceeding No. 16 B. W. G. in thickness. No. 110, shown by the picture, weighs 3,700 pounds, and will cut circles of from 14 inches to 72 inches in diameter from metal not exceeding No. 10 B. W. G. By addressing the E. W. Bliss company, 16 John street, Brooklyn, N. Y., additional information may be procured.



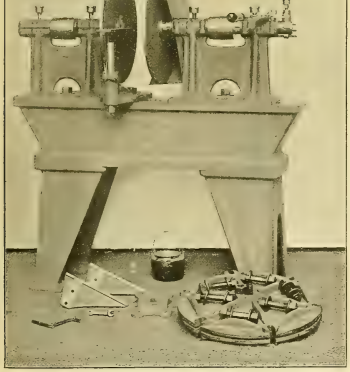
FEEDER POTENTIAL REGULATOR.

## Feeder Potential Regulator.

A simple and practical device for controlling the voltage on alternating current circuits is the new feeder potential regulator (type M R) constructed by the General Electric company and herewith illustrated. In this regulator, by the mere turning of the iron core by a small hand-wheel, the effective voltage is raised or lowered, no movement of contacts or change of connection being necessary. The principle involved is that of varying or reversing the mutual induction of the coils by change in position of the iron core, one coil being connected in shunt to the circuit, the other in series.

The utilization of this principle permits of continuous variation in the voltage, as the core is turned, without any of the abrupt, intermittent steps so noticeable with other devices for feeder regulation. This regulator acts as a transformer, not as a reactive coil; its effect in raising or lowering voltages is practically independent of the current in the circuit to which it is connected.

In construction the device is extremely simple, and, consisting as it does, of laminations of simple form and



GARDNER DOUBLE DISK GRINDER.

Fig. 1.

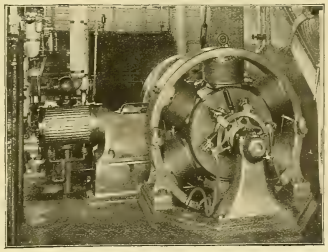


Fig. 2.

ELECTRICITY ON AN OHIO RIVER STEAMBOAT.

large machine wound stationary coils, it is practically indestructible. The uses of this regulator are numerous. It may be employed as a regulator for controlling the voltages on alternating current feeders, as a dimmer for theater lighting; as a controller for series street circuits, and as a pressure adjuster on different branches of unbalanced polyphase or three-wire circuits. It may also be employed as a transformer of adjustable ratios wherever it is desired to obtain alternating currents of variable pressure. It can, of course, be wound for any voltage.

## Northwestern Electrical Association.

The following circular has been prepared by Thomas K. Mercein, secretary of the Northwestern Electrical association:

The fourth semi-annual convention of this association will be held at Marinette, Wis., commencing at 9:00 A. M. on Wednesday, July 15th. Papers on "Insurance," "Incandescent Lamps," "Rights of Electrical Companies," "Lightning Arresters," "Alternating Current Motors," "Storage Batteries," "The New York Convention and Exposition," and other subjects, will be presented and discussed. The entertainment committee's programme includes picnics, bathing and boating parties, log-rolling frolics, bay excursions, trolley parties, banquet, etc. Hotel rates have been arranged at $2.00 and $2.50 per day. Indications point to a large attendance, and rooms should be secured in advance. Address H.

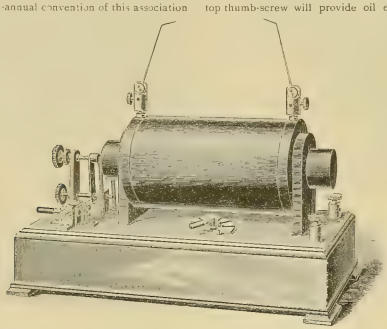


FIG. 1. IMPROVED INDUCTION COILS AND VARIABLE CONDENSERS.

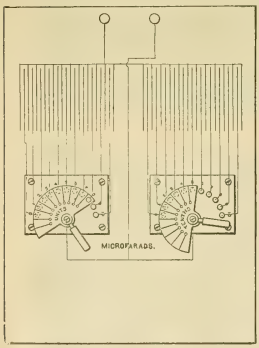



FIG. 2. IMPROVED INDUCTION COILS AND VARIABLE CONDENSERS.

C. Higgin, Marinette, Wis. The Western Passenger Association has granted a rate of one fare on the certificate plan from all points in its territory to Marinette and return. For certificates, it is necessary to secure this rate. As mileage books at the one cent rate practically cannot have certificates issued upon them, holders are requested to postpone their purchase of this character, if practicable, and purchase a single trip ticket with certificate, thus without any additional cost to themselves, assuring two certificates to the association, and the consequent one-third return fare to all members. Any agent selling tickets to Marinette by way of Ford River should get certificates from selling agent, and the certificates will be collected on arrival.

Special through cars for members and their friends will be attached to the Chicago & Northwestern fast train, leaving Chicago at 3:00 P. M. on Tuesday, July 14th; Waukegan, 3:50; Kenosha, 4:08; Racine, 4:22; Milwaukee, 5:00; Oshkosh, 7:15; Neenah, 7:37; Appleton, 7:47; Kaukauna, 8:02; DePere, 8:29; Green Bay, 8:50; Oconto, 9:43; and arriving at Marinette at 10:20 P. M. A substantial cold supper will be served on the train.

## Menominee Fan Motor.

The picture shows the well constructed and durable fan motor for direct current made by the Menominee Electric & Mechanical company of Menominee, Mich. This motor is ornamental as well as efficient, all parts being finished in nickel. It has a knuckle joint, by which the direction of the stream of air may be changed to any angle desired. It is provided with oil cups which are filled with oil enough to last the season; a turn of the top thumb-screw will provide oil enough for a week's running. The diameter of the fan is 12 inches, and all motors have nickel-plated guards. The company makes a specialty of small power motors from one-eighth to five horse power, which are substantial and handsome and give general satisfaction.

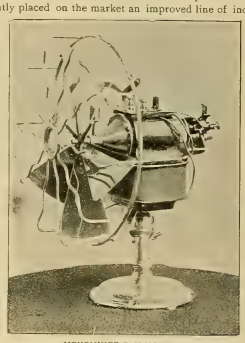
## Dental Battery Outfit.

In the new dental battery outfit illustrated the battery consists of eight cells of the well-known Edison-Lalande battery type "W," which is used for battery dental outfits on account of its long life, freedom from waste and constancy of current. The reversible motor is placed on the floor and mounted on an oak base, having a cover which fits entirely over it, to protect it from the dust, leaving only the pulley exposed. It is belted to the Gilbert adjustable arm by a round cord belt similar to that used on the foot engine. The reversing foot-switch is fitted with forward and backward movement, and also instantaneous stop attachment when the motor is running in either direction. The rheostat is equipped with two sets of binding posts, one of them being for the motor connection and the other for attaching an electric plugger, mouth lamp, but air syringe or electro cautery, as may be required, it being so constructed that it will regulate the current perfectly for all these various devices.

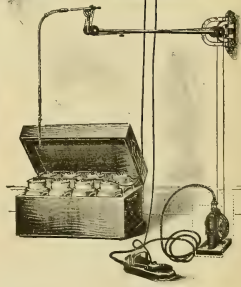
The Gilbert wall bracket has an adjustable movement which enables it to be raised or lowered through an angle of 90 degrees, thereby avoiding the necessity of raising or lowering the chair. It has also an extension movement of about 12 inches which can further be used as a belt tightener. The upright socket at the end of this wall bracket is of the standard size to enable any S. S. White engine-head to fit into it without alteration. The engine-head can therefore be removed at will from the foot engine, and attached to the electric motor without a moment's delay. This bracket is finished throughout in polished nickel, and is of handsome design. The outfit is made by the Edison Manufacturing company, 110 East Twenty-third street, New York city.

## Improved Induction Coils and Variable Condensers.

Elmer G. Willyoung & Co. of Philadelphia have recently placed on the market an improved line of induction coils which are intended to compare in quality with the best types of foreign make, but at much lower prices. Fig. 1 illustrates the new Willyoung coil, from which it will be seen that the general plan of construction, especially as regards the "hammer head" vibrator, is similar to the English Apps coils, the most famous of which was made for Mr. Spottiswood and gave a spark in excess of 40 inches. The iron core in each coil is of best grade Norway iron wire, especially annealed, and each component wire is covered with a thin coat of shellac. The core lies inside of the primary coil and is enclosed in a hard rubber tube of sufficient length to render impossible any sparking of the secondary coil to the core or the primary coil. The secondary coil is wound in a large number of small sections, each insulated from its neighbors, and the coil as a whole saturated with special insulation by an original method in such a manner as to thoroughly exclude air; thus preventing any heating of the solid dielectric by bombardment, and consequent ultimate softening and break-down of the insulation. The electrical constants of the Willyoung coils have been determined with such care and accuracy that high efficiency is obtained, the maximum guaranteed spark length being secured by minimum amount of wire in secondary coil and with least possible weight of the iron core. For ex-



MENOMINEE FAN MOTOR.



DENTAL BATTERY OUTFIT.

ample, in coils of six, eight and 10 inch spark rating not more than one pound of No 31 B. & S wire is used per inch of spark length, while the discharge in each case is exceptionally solid and heavy.

A new feature of great importance incorporated by Willyoung & Co. in their induction coils is a variable condenser as substitute for one of single value as placed in the base of coils of ordinary design. The function of a condenser, as is well known, is to return through the primary coil the energy of self induction produced in it at break in order to hasten the demagnetization of the iron core and thus produce a sudden rise of electromotive force in the secondary coil. As this self-induction energy depends upon the value of the primary current in use, it will be evident that a condenser of but one capacity is only suited for a particular exciting current and a particular primary spark length, without variation in either case. Even the change in electrostatic capacity produced by varying the vacuum tube (such as in X ray work) is sufficient to disturb the proper balance between self-induction and capacity. This not only reduces spark length in the secondary coil, but causes actual heating and combustion of the primary sparking points, with result that repairs are probably necessary. The firm is also making a line of variable condensers for general experimental work, such as the study of resonance phenomena, alternating current investigations, etc. Fig. 2 represents a 10 microfarad variable condenser with 10 sections of one-tenth microfarad each and nine sections of one microfarad each.

The method of construction will meet a demand for condensers, the capacity of which can be varied much more quickly and by much finer subdivisions than is possible in the former "plug-in and plug-out" forms. The regulating switches (see Fig. 3), as in a controlling rheostat, instantly change the condenser capacity with perfect smoothness of operation and effect.

For material of construction tin foil and a specially selected brand of unsized paper are cut to proper dimensions and stacked together dry. These pieces are then subjected to a peculiar insulating process by which every part is permeated with a solid dielectric. Both air and moisture are thoroughly and permanently removed. The condensers are capable of "standing up" continuously and without injurious heat effect on 500 volt alternating circuits, while direct currents of much greater potential can be safely employed.

All of the apparatus manufactured by Willyoung & Co. is sold through their sales agent, James G. Biddle, 944 Drexel building, Philadelphia, who will be glad to send a descriptive circular to those interested.

## CORRESPONDENCE.

### New York Notes.

New York, June 15.—The electrical fraternity in this city has been greatly shocked by the news of the sad accident by which Harrison J. Smith, the superintendent of the Edison Electric Illuminating company of New York, will probably lose his life. Mr. Smith's home is at Plainfield, N. J., and while in the loft of his barn yesterday he lost his footing in some manner and fell to the floor below, a distance of 15 feet. He was picked up, and physicians were hastily summoned. It was discovered that the skull had been fractured at the base of the brain and that Mr. Smith had also sustained internal injuries. Dr. Weir and other specialists who are in attendance are doing everything that medical science suggests for the injured man, but they say that their patient cannot recover.

Mr. Smith is one of the most popular electrical men in this city and is well known to central station men all over the country. He has been a leading member of the National Electric Light association since its formation, and when the National Electrical Exposition company was organized last fall H. J. Smith was selected as president. He worked untiringly for the success of the exposition, and the very successful and brilliant display of last month may largely be credited to his efforts. As a central station manager he made a distinct success in superintending the operations of the largest company of the kind in the country. Personally he is very well liked, and his death will be a great loss. W. F. O.

### Northwestern Notations.

Minneapolis, June 12.—The city attorney at Oshkosh, Wis, has begun proceedings to have the franchise of the Central Wisconsin Electric Railway company annulled.

The Sioux City Traction company of Sioux City, Ia., contemplates extending its line from South Sioux City, Neb., to Homer, Neb The estimated cost of the line is $100,000.

The street railway company of Minneapolis has resumed welding the joints of the rails together, making a continuous rail and obviating low joints.

The city of Beatrice, Neb, has begun mandamus proceedings against the Beatrice Electric Light company to compel the latter to operate its cars or have its franchise forfeited. The company found the line was not paying and shut off the current and run one horse car over the line, but has since discontinued even that.

The city of St. Cloud, Minn., has received a reduction of $20 per light per annum on arc lights from the Water, Light & Power company. The price has been $120 per year

The officials of Hancock, Mich, are securing information in regard to municipal electric light plants.

A petition for electric lights has been circulated at Le Roy, Minn.

A company has been organized at La Crosse, Wis., to manufacture the adjustable shade lamp for electric lights patented by Arthur Espensen, who is interested in the company. The capital stock is $7,500.

The contest growing out of the attempt of the council of Little Falls, Minn., to annul the contract with the Electric & Water Power company for electric lights has at last culminated in the lights being shut off the streets. The company proposed to make a temporary contract pending the decision of the courts as to the validity of the contract, but the council rejected the offer and the company shut off the light to stay off until the affair is settled.

During a severe electrical storm last week the iron poles supporting the trolley wires of the interurban line between Minneapolis and St. Paul were some of them struck by lightning and 30 of them broken off. The poles are made in three sections, and the breaks were all at the joints. The superintendent worked all night and had traffic resumed early the next morning.

William De la Barre, engineer of the St. Anthony Water Power company of Minneapolis, has just returned from a trip East to secure information on the latest electrical machinery to aid in securing equipment for the new power dam now being constructed across the Mississippi River. It will be a long time yet before the dam will be ready for the installation of the machinery plant, but the company is keeping close watch on the latest improvements in that line C

## ELECTRIC LIGHTING.

The New Ulm (Minn.) Electric Light company is in the market for a 50 light arc dynamo and a 50 kilowatt alternator.

At the annual meeting of the shareholders of the Ottawa (Ont ) Electric company the report of the president and directors for the year ended April 30th was presented, showing a gross revenue of $153,788 66, being a satisfactory increase over the previous year A dividend of eight per cent. was declared. The total number of incandescent lights installed is 53,331, an increase of about 5,000 during the year. The number of arc lights is 497, motors, 81; heaters, 119.

## ELECTRIC RAILWAYS.

The good results of the use of electricity for railroad purposes are seen in the circumstance that a fare of five cents between the ferries on the Brooklyn side of the East River and the village of Jamaica has just been established. Not only so, but by the system of transfers in general use in Brooklyn one can go from Coney Island or Fort Hamilton to Jamaica for the same modest outlay. This is a distance of nearly 20 miles.

The Robison street car lines and electric lighting plant property, known as the Toledo Electric Street Railway company, have been sold to the New York banking house of Blair & Co., of which John J. Blair is the head. The sale has excited some surprise, as it was supposed that the Chicago syndicate headed by Messrs. Hale and Ream was in active negotiation for the plant. The latter gentlemen are the owners of the Toledo Traction company, which, with the Robisons, divides the traction business in Toledo. The parties to the sale are very reticent as to the consideration paid. The Robison lines were mortgaged to the amount of nearly $2,000,000. The New York Security & Trust company holds a mortgage for $1,750,000, and the New York Guaranty & Indemnity Trust company has another for $100,000. The organization of the new company is as follows: James A. Blair, New York, president; John B. Dennis, vice-president and treasurer; James E. Robison, general manager; Willard Robison, secretary. The foregoing and W. M. Ferris make up the directory.

## TRADE NEWS.

The F P Little Electrical Construction & Supply company, 135 Seneca street, Buffalo, N Y, is now agent for lighting apparatus and supplies in Erie county for the General Electric company

L. W Kingsley, secretary of the Mica Insulator company, 218 Water street, New York, sailed on June 3d on the steamship St. Louis for a trip abroad, where he will spend considerable time in sight seeing as well as looking after the affairs of the company in Europe. The company's business is largely increasing in foreign countries, which is due to the high grade of insulation "Micanite" it is furnishing to the manufacturers of electrical machinery in European countries. At the newly equipped factory, which is located at Stoke Newington, London, upward of 100 hands are given employment. The London office is at 12 Camomile street.

The field of enclosed arc lighting is being entered by quite a number of concerns. The Electric Arc Light company of New York, proprietor of the Pioneer lamp, claims the prior right to this method of arc lighting, and it is understood that a strong fight will be made to maintain this position. The Electric Arc Light company was a very modest and conservative concern with only one aim to manufacture Pioneer 150 hour enclosed arc lamps but now that, as it claims, others are disregarding its patents, and encroaching on its territory, it has become aggressive, and has organized with an immediate backing of $2,000,000 and offers which it claims will reach nearly $5,000,000 more. This will secure for the Pioneer lamp the opportunity to have the rights claimed for it established. Since Professor Louis B. Marks first proclaimed the practicability of enclosed arc lighting, he has been constantly experimenting and improving his original mechanism, until now he declares that all users of the Pioneer praise it as the most satisfactory light yet obtained, being economical, shadowless, steady and safe.

## BUSINESS.

The Electric Appliance company is meeting with considerable success in the use of Packard mogul lamps for lighting parks and summer gardens. One of Chicago's largest pleasure resorts of this kind, Thielmann's garden, near Lincoln Park, has been lighted entirely with Packard mogul lamps for two seasons with such success that the Electric Appliance company is making special efforts to extend the use of the mogul lamps for this class of work

The Standard Paint company reports that it is having an unusually large business for this time of year. The export trade is nearly three times as large as it was last year, the company having recently received an order from Sydney, Australia, for insulating material for a large amount. This concern has recently received its diploma from the World's Fair officials, and states that it was the only firm to receive a diploma for insulating compounds.

Eugene Munsell & Co., miners and importers of mica, 218 Water street, New York, and 153 Lake street, Chicago, are enjoying an excellent trade on India mica, of which they make a specialty, being direct importers from the mines, and employing a large force in selecting the mica. They are in a position to furnish it cut to size and stamped to any shape or pattern for electrical insulation. They have just issued a neat price-list, which is being mailed to the trade, and offer to send samples and quotations on application.

The Dayton Globe Iron Works company, successor to Stout, Mills & Temple, Dayton, Ohio, is shipping to the Boston & Montana Consolidated Copper & Silver Mining company, Great Falls Montana, the largest and most powerful pair of horizontal turbines, under the head they will operate, that have ever been turned out in this country. These turbines are of the latest design, 57 inches diameter, and, under the average head they will work, will develop 3,258 horse power. The turbines are placed on a cast-iron draft chest and discharge centrally through a draft tube, and are surrounded by an iron flume 14 feet six inches in diameter and 32 feet six inches long. The whole is mounted on double I-beams on each side 20 inches deep, 38 feet long, with four cross I-beams. The shaft is 10 inches in diameter, 42 feet two inches long, and is made of the best hammered iron. The weight of the shaft alone is over five tons. It is made in two sections. The coupling, which couples the sections together, weighs over one ton. There are stands outside of the flume at each end which support the shaft. Each of these stands weighs 8,000 pounds, on which is placed babbitt-lined journal boxes, in which the shaft revolves. The two turbines and outfits complete weigh 250,000 pounds or 125 tons, and will require seven cars of nearly 20 tons each to transport them. These turbines are to operate two electric generators, one coupled directly to each end of the shaft, which will run 144 to 160 revolutions per minute, and will be used for smelting. The varying revolutions are required in order to increase or diminish the blast as conditions may require. The whole outfit is made of the best material and workmanship, and certainly does great credit to the engineering skill of the Dayton Globe Iron Works company, and shows its ability to turn out this class of machinery on a mammoth scale. W. M. Mills, vice-president and general manager of the Globe Iron Works, the veteran turbine builder, says that if a pair of 57-inch turbines of this design and capacity were put in operation on the new water power at Niagara Falls, under 140 feet head, they would develop 18,494 horse power and would require a hammered iron shaft 15 inches in diameter to safely transmit the power, estimating the power to be taken off at each end of the shaft, as it will be done at Great Falls.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued June 9, 1896.*

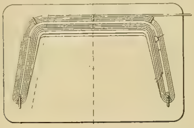
561,560. Electric Arc Lamp. Sigmund Bergmann, New York, N. Y. Application filed February 27, 1895.

The combination is claimed of a movable carbon support, a clutch for coacting with the support, a pivoted frame provided with arms on each side of the carbon support which are adapted to impinge against the clutch and cause its engagement with the support, a stop piece also adapted to impinge against the clutch and cause its disengagement from the support, and a shunt electro-magnet for moving the pivoted frame.

561,565. Automatic Electrical Battery Cut-out. Harry W. Clelland and Frank J. Madden, Wilkinsburg, Pa. Application filed December 11, 1895.

A battery or series of batteries is suitably connected by wires to binding posts, the batteries carrying a float having an upright rod secured thereto, the rod being slotted and provided with an adjustable arm having a hooked portion, and a wire connecting an auxiliary battery to a bell.

561,581. Electric Switch. Monroe Guett, Hartford, Conn. Application filed November 29, 1895.



NO. 561,656.

A base bearing a stationary pole adapted to be connected with one of the circuit wires, a lever pivoted to the base so that one end will swing into and out of contact with the stationary pole, and adapted to be connected with the other of the circuit wires, a block pivoted to the base and having a handle projecting in one direction and an arm projecting in the opposite direction, a spring between the end of the arm projecting from the block and one end of the lever, this end of the lever having an inward projecting stud, and the block having a pair of outward projecting lugs arranged to engage the stud and hold the lever against movement until the spring has reached the desired degree of tension for properly throwing the lever.

561,588. Electric Switch. Julius L. Hornig, St. Louis, Mo. Application filed August 26, 1895.

A spring-actuated disk of insulating material, a conductor plate arranged in the disk in such a manner as that its ends appear on the periphery, two contacts which co-operate with the conductor plate, suitable mechanism for tripping the disk, and a float or its equivalent for operating the tripping mechanism.

561,590. Armature for Dynamo-electric Machines. Francis P. Ide, Eau Claire, Wis. Application filed April 14, 1896.

One feature is the combination of a core with armature coils disposed thereon, and U-shaped retaining links adapted to secure the coils in position.

561,593 Dynamo electric Generator. Benjamin G. Lamme, Pittsburg, Pa Application filed September 4, 1895.

Two commutators and two sets of armature coils are arranged in pairs, the pairs of each set being at right angles to each other, and the two sets being connected in series through the commutators.

561,601 Register for Telephones. Edwin L. Morey, Portland, Ore. Application filed August 13, 1895.

An indicating strip or ribbon is arranged within the casing, with feeding mechanism for advancing it through an opening of the casing, a shaft is connected with the feeding mechanism a ratchet wheel is mounted on the shaft, means for communicating motion from the fork of a telephone to the ratchet wheel are provided, and there is a clutch for detachably keying the ratchet wheel to the shaft, and operating mechanism for throwing the clutch out of engagement with the ratchet wheel

561,619. Toll Counter for Telephone Lines. Gustave P. Seligmann Lui, Paris, France Application filed August 18, 1894

There are a number of plug circuits and a single main relay, and a source of current connected therewith, an auxiliary relay to each plug circuit controlling the continuity thereof and controlled by the main relay, and means for connecting the main relay with any plug circuit

561,636. Form for Winding Armature Coils. James A. Webber, Lynn, Mass. Application filed January 25, 1896

This is a winding form for armature coils, comprising a suitable base, means for confining the coil, and a series of terraces or grooves upon which one part of the coil is wound

561,653 Telegraph Relay Edwin Butler, New York, N. Y. Application filed June 15, 1893.

Included in this device are a pair of electro magnet coils provided with cores, an armature therefor opposed to both [illegible] and a solenoid surrounding the shaft of the armature [illegible] being in circuit with the magnet coils.

561,[illegible] Thermo-electric Generator Harry B Cox, Hartford, Conn Application filed February 13, 1895

[illegible] generator is described, comprising a [illegible] forming a water-jacket, and the removable [illegible] forming the inner wall of the water [illegible] from the casing without disturbing the [illegible]

561,699 Electric Motor William H Cooley, Brockport N. Y. Application filed March 12, 1895

In [illegible] current machine, in combination with the [illegible] rectifying devices carried by [illegible] and co operating with others carried [illegible] tying [illegible] rotation between such third [illegible] carrying such rectifying [illegible]

561,700. Electric Motor. William H. Cooley, Brockport N. Y. Application filed March 12, 1895

[illegible]

thereon, in combination with other gear engaging the teeth on such commutator, such other gear divided on their plane of rotation, and means for producing an angular displacement between the parts thereof.

561,711. Electric Meter. Ralph O. Hood, Danvers, Mass. Application filed January 26, 1895.

An artificial resistance is placed in series with the starting fixed coils of an electric meter, the whole being in a separately derived circuit, in combination with an electric motor having its main fixed coils in series with the consuming device, and its movable armature coils in a derived circuit, and a magnetic damping device for the motor absorbing the dynamic energy of the coils, and means for registering the revolutions of the motor.

561,735. System of Electrical Distribution. Charles P. Steinmetz, Lynn, Mass. Application filed January 6, 1894.

The combination is claimed of armature conductors arranged in sections angularly displaced in such manner that such sections tend individually to generate currents substantially sixty degrees apart in phase, with means for converting such displaced currents into a three-phase current system suitable for operating three-phase translating devices.

561,777. Electrical Apparatus for Controlling Motion of Cranes, etc. John A. Essberger and Alexius W. Geyer, Berlin, Germany. Application filed September 29, 1894.

In electrically operated cranes or the like having mechanisms for giving motion thereto in directions at an angle to each other there is a single controlling lever movable in different directions to put into operation the different mechanisms according to the direction of movement given such lever, and two resistances controlled by the lever, and shafts carrying the contact arms of the rheostats, the shafts being arranged at an angle to each other, and having a connection comprising rings arranged one within the other, the outer ring carrying the controlling lever.

561,803. Dynamo-electric Machine. Fritz G. Mayer, Chicago, Ill. Application filed October 18, 1895.

Features claimed for this apparatus include an outer casing and a core concentric therewith, and an armature mounted upon a shaft running in bearings in the core, the armature consisting of a core adapted to revolve between the outer casing and the concentric core, and having a series of concentric metallic cylinders mounted thereon, the cylinders being insulated from each other and from the core.

561,810. Electric Battery Element. George J. Ortner, Pueblo, Colo. Application filed February 18, 1896.

This is a zinc element for a battery, comprising a hub portion having a tapered opening, an amalgamated zinc supporting stem having a tapered portion at its lower end, having a length substantially equal to the length of the opening in the element hub, and having a straight cylindrical portion above the tapered portion of a diameter equal to the smaller end of the opening through the hub.

561,821. Electric Railway. William M. Schlesinger, Philadelphia, Pa. Application filed August 4, 1885.

An electrical conductor is composed of superposed plates of copper and iron or steel of segmental form in cross-section, in combination with traveling brushes contacting with the steel or iron plate of the conductor.

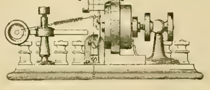
561,828. Electric Elevator. Humphrey R. Smith, Chicago, Ill. Application filed March 16, 1896.

In an electric elevator there is a hoisting motor, comprising a soleno d having a stationary core, and a movable coil, the coil connected to the car-hoisting cable.

561,830. Electric Railway. Charles E. Stanley, Gallipolis, Ohio. Application filed September 27, 1895.

One track rail has a wide groove in its head and a narrower groove in its web communicating with that in its head, and an electric conductor is seated in the narrower groove and projects into the wider groove; car wheels running upon the rails and formed with grooved flanges projecting into the wider groove receive the upper end of the conductor. Electrical connections are made between the wheel flange and car motor.

561,838. Arc Interrupter for Street Car Controllers. Gustaf Valley, Cleveland, Ohio. Application filed February 10, 1896.



NO. 561,653.

The last claim is for the combination of the drum, composed of annular disks secured upon a shaft, an electro-magnetic coil upon the shaft, cylindrical pole-pieces extending from the shaft along the coil, and projections from the pole-pieces extending through the disks in proximity to the contact pieces thereon.

561,839 Reversing and Cut-out Switch Used in Electric Street Cars, etc. Gustaf Valley, Cleveland, Ohio. Application filed February 26, 1896.

A combined reversing and cut-out switch for electric street cars is described, comprising in combination a rotatable drum, having upon its periphery and projecting therefrom a plurality of bridging contacts arranged in two sets of longitudinal series, one set arranged to pass the current in the forward direction, and the other to pass it in the reverse direction, and different series of each set operating to cut out one or the other motor respectively, and a series of fixed contacts arranged in the path traversed by the contacts of the drum, and having electrical connections with the circuit in which the motors are operated.

561 846 Automatic Motor Stop William M. Wood and James C Miller, Elmira, N Y. Application filed October 21, 1895

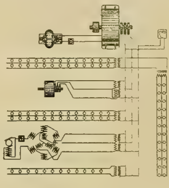
The principal feature is a governor, comprising an adjustable weight controlled by an adjustable spring and provided with a projection, a trip device in line with the projection when the governor is actuated by undue speed of the motor a circuit closer operated by the trip device, and a stop mechanism set in motion by the electric current so established

561,847. Automatic Motor Stop. William M. Wood and James C. Miller, Elmira, N. Y. Application filed October 21, 1895.

The governor is made up as follows: A shell or case adapted to be attached to a rotating part, a rod within the shell acted upon by a weight thrown out by centrifugal force, one end of the rod being adapted to strike the terminals of an electric circuit, and means for adjusting the distance between the terminals and the end of the rod.

561,867. Electric Motor and Motor-generator. William H. Cooley, Brockport, N. Y. Application filed May 21, 1895.

This machine comprises a compound element, one of the component parts of which is located in operative relation to a second element, and constituting therewith the armature and field of a motor proper, the other component part of such compound element located in operative relation to a



NO. 561,735.

third element, and constituting therewith the armature and field of a motor-generator, electric conductors constituting a winding on one of such motor-generator elements independent of any winding supplied with electric currents for producing magnetic poles in such motor-generator element, means independent of relative rotation between such motor elements for maintaining a relative rotation between such motor generator elements, such generative winding connected in series with the windings on one of such motor elements.

561,872. Electrical Accumulator. Gaston de Schrynmakers de Dormael, Brussels, Belgium. Application filed May 1, 1895.

The depolarizing peroxid is arranged in direct contact with the negative material.

561,878. Galvanic Battery. Thomas E. Fogalsang, Sacramento, Cal. Application filed July 29 1895.

An acid electrolyte is mixed with a solution of eucalyptus.

561,881. Electric Chime. James H. Gerry and Frederick M. Schmidt, Brooklyn, N. Y. Application filed March 18, 1895.

The arrangement comprises the set of chimes and hammers therefor, the solenoids and their cores corresponding to the several hammers, the several relays having their contacts in circuit each in series with one of the solenoids and in multiple arc with the remainder, and its magnets in series with one of a set of circuit-closing devices, and means for operating the circuit-closing devices.

561,886. Igniting Device for Gas or Petroleum Engines. Arthur A. Hamerschlag, New York, N. Y. Application filed February 17, 1896.

Two or more sparking devices or igniters, a divided induction coil including the devices in the secondary circuit, and a battery or other electric generator in the primary circuit.

561,898. Electric Railway. Paul W Leffler, Chicago, Ill. Application filed August 12, 1895.

The armature on the car is formed by the extended core, with laterally projecting pole pieces and coils wound around the core between the pole-pieces, electric connections to the coils, and automatic pole-changing mechanism applied to the electric connections.

561,899. Continuous Current Rectilinear Motor. Paul W. Leffler, Chicago, Ill. Application filed October 8, 1895.

The combination is claimed with a number of polar projections or poles of alternate polarity situated along the way or line of travel, of a magnetic core mounted upon the vehicle, the ends of the core being joined together to form a complete magnetic circuit or ring, a number of coils wound upon the core, the ends of adjacent cores being united, the end of the first coil being also connected with the end of the last coil to thus form a closed circuit, a commutator, the segments of which are connected respectively with the ends of the coils, and brushes bearing upon the commutator and connected with a source of electricity.

561,918. Electrical Measuring Instrument. Henry A Rowland, Baltimore, Md. Application filed October 2, 1895.

Two fixed coils with connections for passing the electric current through either one of the coils, and one movable coil, with means for passing the shunt current therethrough

561,919. Electrical Measuring Instrument Henry A Rowland, Baltimore Md Application filed October 2, 1895.

A feature of the invention is a pivoted arm carrying a reading scale, and a shunt box connected to the terminals of the instrument

561,943. Electric Self-winding Clock. Robert A Mitchell, Brooklyn, N. Y. Application filed January 16, 1895

In a self winding clock the combination is claimed of the electro magnet, having means for intermittently energizing it, the vibrating armature pivoted and having a counter weight and arm, the latter bearing a segment rack, the pinion with disk free to revolve on its shaft, spring pawl and ratchet wheel connected to the winding train.

561,951. Electrical Connection Theodore Grutting, St Paul, Minn. Application filed August 10, 1892.

In an electrical connection for heaters the annular contact rings are adapted to be seated upon each other to form a tight joint, one of the rings being of fusible and softer metal than the other, and means for securing the rings upon each other.

Western Electrician.

EVERY SATURDAY.

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## Electrical Operation of the Lake Street Elevated Railroad.

As announced in this journal last week, the electrical operation of the Lake street "L" road in Chicago was begun on June 14th. While it is unquestioned that the new method of using power will prove, ultimately, a great success, it is true that several accidents—notably a serious one on June 20th, by which a motor car jumped the track at Rockwell street and dashed to the street level below, injuring several people—have marked the introduction of electric power. These accidents are not chargeable to any inherent defect in the electrical method; but it is thought that the motor trucks are too light, and improvements to meet this objection are under way.

The road is 6½ miles long, extending due west on Lake street, from State street. It has been operated for over two years with the use of 35 steam locomotives, and 30 motor cars have been fitted up to utilize the electric power. The estimates of economy in operation which induced the company to expend $200,000 in making the change have already appeared in this journal, and there is little doubt that they will be justified by the results of actual practice. The elevated structure supports two traffic tracks for the whole length of the line, and also a third track, about two miles long, for switching and storage purposes at the western end.

The Lake Street Elevated Railroad company is closely allied with the North and West Side surface street railway companies controlled by Mr. Yerkes, and an arrangement was made whereby electric power was secured from the great generating plants of these companies. To guard against the possibility of failure of power, no single station is relied upon, although any one of the contributory power plants can supply all the current needed, in an emergency. The system is divided into three sections. That part of the road from State street to the river gets its power from the Hawthorne avenue power house of the North Chicago railway; that part from the river to Forty-fourth street from the Western avenue power house of the West Chicago system, and that between Forty-fourth street and Fifty-second street, the western terminus of the road, from the power house of the Cicero & Proviso road at Oak Park. The central section is the longest and most important. It depends for power directly on the great station of the West Chi-

Feeder Ducts from Power House at Western Avenue. View of the Structure at Garfield Park, Showing Third Rail. Car on the Incline at Fortieth Street.

FIG. 1. ELECTRICAL OPERATION OF THE LAKE STREET ELEVATED RAILROAD.—VIEWS ALONG THE LINE

cago company at Western avenue and Washington boulevard, described in the exhaustive article on the North and West Side trolley railway systems published in the WESTERN ELECTRICIAN on July 6, 1895. However, automatic circuit breakers at either end of this section make it possible to feed into it from the other stations named. A potential of about 500 volts is used, as on the surface roads. In the upper left-hand picture in Fig. 1 is given a good view of the ducts containing the rising feeders which connect the underground mains from Western avenue with the feeding cables on the structure.

To conduct the current to the car motors the "third-rail" system is used. The third rail in this case is a

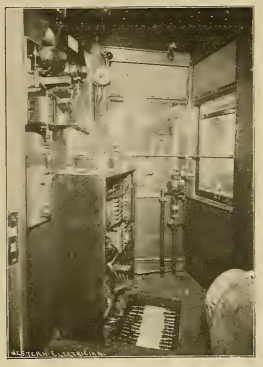


FIG. 3. ELECTRICAL OPERATION OF THE LAKE STREET ELEVATED RAILROAD.—INTERIOR OF MOTORMAN'S "CAB."

five-inch 40-pound steel rail, placed above and at the side of the track rails. Against it, when a train is passing, presses the flat trolley "shoe," which transmits the current to the motors on the trucks. Four feeder cables, of 1,000,000 circular mils each, are laid between the tracks and are tapped into the third rail at intervals. Great care has been taken to insulate the third rail from the structure, and a specially designed insulating support is used. To prevent foreign objects making contact with this rail upright boards project above it on either side, so that it lies in a shallow trough. The third rail can be plainly seen in the general view in Fig. 1, which gives a perspective view of the top of the structure as seen when looking east at Hamlin avenue, with Garfield Park on either hand. The drawing, Fig. 2, will give a better idea of the relative position of the track rails, third rail, protecting boards and trolley shoe. It should be added, also, that a specially designed rail-

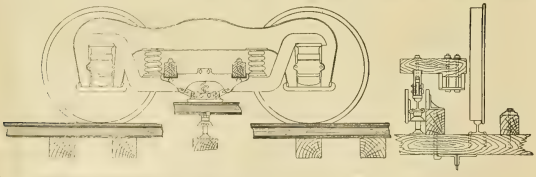


FIG. 2. THE LAKE STREET ELEVATED RAILROAD.—LONGITUDINAL DRAWING AND CROSS-SECTION OF THIRD-RAIL CONNECTIONS.

bond is used, and allows a cross section and allowing more play for expansion and contraction than is usual.

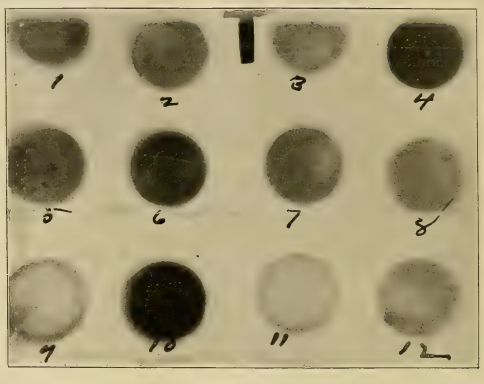
The [illegible] old smoking cars refitted, and [illegible] either end with the controlling and brake [illegible] that they serve their original purpose as well as [illegible] An instantaneous photograph of one of these electric motor cars mounting the incline from the shops to the structure, at Fortieth street, is reproduced in the upper right-hand picture in Fig. 1, while in Fig. 3 is shown the mechanism under the control of the motorman, at one end of the car. The latter picture shows the motor controller (with the front panel and a floor trap removed to show the connections and the ready accessibility of the circuits for repair), the automatic circuit [illegible] above it, the air gauge with its lamp, the air-brake lever and the motor for driving the air pump. The pump itself is direct-coupled to its motor, but does not show in the picture. This outfit is duplicated at the other end of the car, with the exception of the electric air pump, so that the motor car can be operated with equal facility from either end—a "double-header," as it were. Each car has one truck equipped with two massive General Electric motors of 100 horse power each and can easily pull two or three trailing coaches at a speed of 30 miles an hour if necessary.

With heavy trains and frequent stops it is very important that the braking apparatus be powerful, quick-acting and efficient. On the Lake street line the Westinghouse automatic air-brake system is used. It is employed in the same manner as on steam roads, the principal difference being the fact that the pump is driven by an electric motor of three horse power. This motor is placed in the motorman's "cab," as already explained. These air brakes are instantaneous or gradual in application, as desired, and are very powerful, stopping a four-car train, it is claimed, when going at full speed, within a train length and a half. As an additional measure of precaution a steel cord connected with the air-pressure valve is run from end to end of the train. Thus, should the motorman be asleep or ill at his post, any passenger can stop the train instantly by jerking the cord and applying the air-brakes.

All the cars are heated and lighted by electricity. The current from the motor car circuits is taken to the trailers by insulated plug couplers. Each car has 10 electric heaters, made by the Consolidated Car Heating company of Albany, N. Y., under the seats. Light is furnished by 16 candle power incandescent lamps—20 in each motor car and 10 in each coach. The motor cars are equipped with electric headlights and signal lights as well as lamps for general interior illumination. The electric lighting makes the cars very bright and cheerful at night, and it is anticipated that the electric heaters will be entirely adequate in cold weather.

The interlocking system is used for train switching. It is similar to that used on the Pennsylvania and other steam roads. The switching tower can be seen in the upper right-hand picture in Fig. 1.

On Lake street, near Fortieth, are the offices, shops and car house of the road in a brick building 365 feet long and 60 feet wide, rising from the street level. This structure covers four tracks, with pits beneath for the entire length. In front is a machine shop, with tools operated from a counter-shaft driven by a 25 horse power 500 volt General Electric motor. There is a blacksmith shop in a detached building. An electric traveling crane of 60 tons capacity will soon be installed in the car house.



1. Potas. carbonate.
2. Sodium acetate.
3. Sugar.
4. Lead acetate.
5. Aluminum sulph.
6. Copper sulph.
7. Sodium sulph
8. Magnesium sulph.
9. Kerosene.
10. Sulphuric acid.
11. Alcohol.
12. Oxalic acid.

FIG. 2. EXPERIMENTS SHOWING PERMEABILITY OF METALLIC SALTS AND THEIR SOLUTIONS BY RÖNTGEN RAYS.—SCIAGRAPHS OF SALTS IN SOLUTION.

The Lake Street road affords the first instance of a steam elevated railroad company substituting electrical power for its locomotives. Its example is sure to be followed in New York, Brooklyn and Chicago. It differs considerably from the Metropolitan road of the last-named city, the pioneer in its line, and forms an interesting object lesson for railroad men. The men who supervised the work of making the change are Messrs. Chapman, Talbot and Hanson of the electrical department, who co-operated with General Superintendent Hedley, Mechanical Engineer Weston and Roadmaster Comerford.

## Canadian Electrical Association.

The sixth annual meeting of the Canadian Electrical association was held at Toronto on June 17th, 18th and 19th. The sessions were held in the council room of the Board of Trade. The executive committee met Wednesday forenoon and elected 23 new members. There were present at the afternoon's proceedings over 60 delegates, representatives from all parts of the province and more distant points in the Dominion. Among the prominent men in attendance were: President A. B. Smith, Toronto; Secretary-treasurer C. H. Mortimer, Toronto, and the following named members of the executive committee: George Black, Hamilton; J. A. Kammerer, Toronto; E. C. Breithaupt, Berlin; John Carroll, Montreal; K. J. Dunstan, A. M. Wickens and J. J. Wright, Toronto.

In his annual address, President Smith said that since the last meeting there had been a revolution in the field of electrical science, with unlimited possibilities yet to be developed. Apparatus had been discarded as obsolete which a few years ago had been considered colossal. Prosperity and progress were to be noted in all branches of the science. The increase in numbers of electric railways was not the least remarkable of the current developments. The electric motor was now usurping the functions of the steam locomotive. Ere long they might expect to see it on the main lines of railways.

The report of the secretary-treasurer, C. H. Mortimer, showed that during the year there had been a net increase of 13 members, the total membership now being 229. There was reported a balance on the right side of the association ledger. The report was adopted. Ezra C. Breithaupt, electrical engineer, Berlin, presented the report of the committee on statistics.

A paper was read by George Black of Hamilton, on "Acetylene Gas," which was supplemented by experi-

ments illustrating the points referred to. In a discussion which followed the general opinion expressed was that the promoters and inventors of this gas were too optimistic as to its possibilities.

In the evening members of the association, with their lady friends, attended an illustrated lecture by James Milne, electrician of the Toronto Electric Light company, in the Board of Trade rotunda. The lecture was entitled "Radiant Matter," and included an exhibition of Prof. Clarke's experiments and also demonstrations of Röntgen rays. Some interesting sciagraphs were taken and exhibited.

At the close of the day's proceedings the members and their friends took advantage of invitations to visit and examine the power plants of the local electric lighting and street railway companies, and the equipment of the stations was fully explained by attendants.

The second day's session was opened with the presentation of reports of standing committees. Most of the morning was devoted to the reading of a paper on "Meters" by James Milne of Toronto and a discussion on the government electric light inspection act. This discussion was prolonged into the afternoon and was followed by the election of officers for the ensuing year, which resulted in the selection of the following named gentlemen: President, John Yule, Guelph; first vice-president, L. B. McFarlane, Montreal; second vice-president, E. C. Breithaupt, Berlin; secretary-treasurer, C. H. Mortimer, Toronto; executive committee, George Black, Hamilton; J. A. Kammerer, Toronto; John Carroll, Montreal; K. J. Dunstan, Toronto; A. M. Wickens, Toronto; J. J. Wright, Toronto; J. Hunt, London; W. Armstrong, Toronto; Ross Mackenzie, Niagara Falls; and A. B. Smith, Toronto. It was decided to hold the next annual convention at Niagara Falls. F. C. Armstrong read a paper on the "Outlook for the Electric Railway."

At five o'clock in the afternoon the delegates and their friends left on an excursion by the steamer Greyhound to Lorne Park, where the annual banquet was held at the Hotel Louise. Over 100 guests were present. The hall in which the banquet was held was decorated with flags and flowers. An orchestra in attendance added greatly to the evening's enjoyment. After spending an hour in walking about Lorne Park the party left shortly after 11, arriving in the city after midnight. A pleasant feature of the trip home was the presentation of a cane to A. B. Smith, the retiring president. The presentation was made by O. Higgman of Ottawa on behalf of the members as a recognition of Mr. Smith's services to the association. Short speeches were made by Principal Galbraith of the School of Practical Science, E. C. Breithaupt, Mr. Smith and Mr. Mortimer.

The convention closed on Friday, June 19th. At the morning session P. G. Gossler of Montreal read an interesting and instructive paper on "Some Central Station Economies." George W. Fraser of Toronto submitted a paper on "Power Transmission by Polyphase Electromotive Forces," with demonstrations. In the afternoon E. J. Phillips of Toronto read a paper on "Operating Engines Without a Natural Supply of Condensing Water," after which the members of the association enjoyed a sail around the Island and along the water front, down as far as Scarboro Heights. The meeting was by far the most successful in the history of the association, and the members were greatly encouraged by the increasing interest manifested by representatives of all branches of the industry.

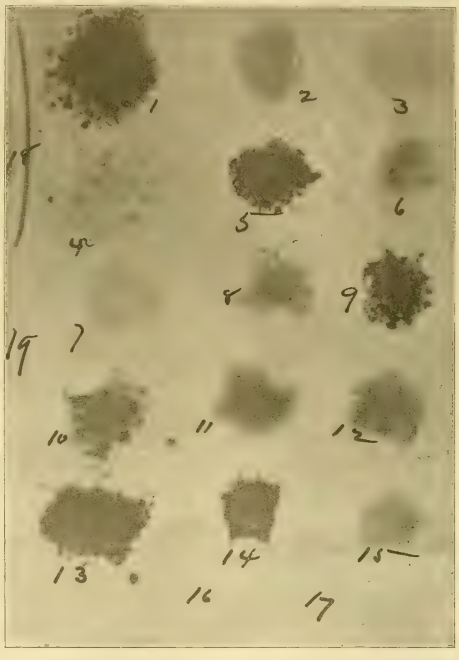
## Storage Battery Business.

At the annual meeting of the Electric Storage Battery company a statement was submitted showing the receipts for the year to have been $328,231 and the profit $124,733. The general expenses amounted to $123,969. The gross business for the five months of the present year amounted to $415,000, and on that basis President Gibbs estimates that the receipts for the year will be not less than $1,000,000, and possibly considerably more, as the business is steadily increasing. The Electric Storage Battery company now owns nearly 900 patents on batteries. The character of the business done so far has been mainly for central stations and large buildings, with a good sprinkling of telegraph, telephone and other lighter work. A storage battery railway is under construction in Chicago. An important new field is now opening in connection with trolley lines, the storage batteries being used as auxiliaries to that system, the first installation of the kind on a large scale in this country being on the lines of the Union Traction company of Philadelphia. The most important contract so far made is with the Hartford Electric Light company, and when completed it will provide, it is said, the largest single installation in the world.

## Experiments Showing the Permeability of Metallic Salts and Their Solutions by Röntgen Rays.

By Joseph F. Smith

It is well known that metals differ in their permeability for Röntgen rays. It was the purpose of the experiments which resulted in the pictures herewith presented to ascertain whether this difference of permeability extends also to the salts of the metals and to solutions of the salts in water. To ascertain the first, salts of several different metals were carefully pulverized and then placed upon a thin board having a plane surface, arranged is shown in Fig. 1. The thin board was placed above a plate holder containing a sensitive plate. A piece of plate glass was placed on top of the board and pressed down so that the piles of salts were compressed to a thickness of two millimeters. The plate glass was removed and the salts exposed to the radiation from a Crookes tube for five minutes. Upon development the plate showed plainly that the salts possess very different permeability, as an examination of the reproduction will show, those salts that give the darkest sciagraph on the print being least permeable and those that give the lightest print the most permeable.




1. Potas. sulph.
2. Sodium sulph.
3. Magnesium sulph.
4. Sodium acetate.
5. Lead acetate.
6. Potas. bitartrate.
7. Sugar.
8. Aluminum sulph
9. Copper sulph.
10. Sulphur.
11. Calcium hydrate.
12. Ammonium chloride
13. Manganese dioxide.
14. Arsenic oxide
15. Silicon dioxide.
16 and 17. Oxalic acid
18 and 19. Magnesium wire and ribbon.

FIG. 1. EXPERIMENTS SHOWING THE PERMEABILITY OF METALLIC SALTS AND THEIR SOLUTIONS BY RÖNTGEN RAYS. —SCIAGRAPHS OF SALTS

To ascertain whether this same difference is to be found in the solution of the salts, paper pill boxes one centimeter deep and two centimeters in diameter were dipped repeatedly in melted paraffine until the pores were thoroughly filled. Solutions of .25 gramme of various salts in two cubic centimeters of distilled water were placed in the paraffined boxes, and, at a temperature of 16° C., exposed for eight minutes to the action of Röntgen rays. Development of the plate showed plainly (Fig. 2) that the same difference of permeability extends also to the water solutions of metallic salts. In Fig. 2 Nos. 9, 10 and 11 are interesting as showing the difference in the permeability of kerosene, sulphuric acid and alcohol respectively.

From these and other experiments it seems that the permeability of a metallic salt or its solution depends upon the positive radical and is proportional to its combining weight.

## Should Employes Read the Business Paper?

By N. C. Fowler, Jr.

In every mercantile reading room are filed the representative trade and commercial papers. In nearly all business and factory offices are kept the trade papers representing the industries.

Intelligent manufacturers and managers read their trade papers regularly and carefully, and when they are through with them, they are handed to the department heads, and from there reach every class of employe, except that of ignorant labor.

The good trade paper is not only a correct mirror of business, but it is a text-book, and a volume of successful lessons. Where you see success there you see trade papers. The trade paper is a necessity, and is more and more being so recognized, for, faulty as it may be, and there is nothing perfect, it is the best arena for the exchange of thought, and for practical illustration of successful making and doing.

The capitalist should read the trade paper, because it tells him how his money is making money. The active manager should read the trade paper, because it tells him what is going on, and is constantly furnishing him with ideas, or the suggestions which better enable him to produce ideas of his own. The superintendent should read the trade paper, as he would read any other work of business education. The workman should read the trade paper, because it broadens the scope of his mind, and lifts him out of mechanical ruts.

The trade paper should be in every office, in every superintendent's room, and in every reading room for workmen. If there be many employes there should be many copies of the same paper.

Are trade papers read?

Look at the crumpled pages; see how they show the effects of handling and rehandling. If you then doubt that the trade paper is read from beginning to end, put a little item about yourself in the most obscure corner, and count the number of references by mail, and verbally, that come to you concerning it. Get married, and ask the trade paper to print the marriage notice. Visit your cousins, and the cousins of your cousins, if they are in your trade, and there'll be no need of telling them about it.

If all the folks in trade who know you will read these little social items, how much more reason there is to believe that they will read the words which mean more business fo[illegible] them.

Each copy of a daily paper may have but one reader, but [illegible] from one to 100 readers.

You will not have to make your employes read the trade paper [illegible] have to [illegible] uggest it [illegible] you [illegible]

[illegible] there is more food [illegible] paper than there is [illegible] publication [illegible] erhaps the editor [illegible] in all that he [illegible] be editing a trade [illegible] for him in some other [illegible] sometimes or wrongly [illegible] employe can, by using his mind, learn manufacturing affirmatives, by reading the [illegible]

The reason that trade paper advertisements are read more than any other class of advertisements is because the trade paper advertisement contains money-bringing information, and everybody in trade is interested in what everybody else in the same trade has to say to the public, and the trade paper advertisement is the cheapest, easiest and most sensible method for the man who makes and sells anything to tell the man who buys that something that he has that article for sale.

## Some Account of the Evolution of the Inductor Alternator.[1]

By John F. Kelly.

Part I.

In beginning this brief sketch of the evolution of the inductor alternator,[2] I wish to define my conception of the type, as I have found it necessary to include some machines not usually regarded as inductors. An inductor alternator, as I understand it, is one in which the electromotive force in the induced coil is the result, not of changes in the space relations between such coil and the flux-producing agency, but of changes in the flux through said coil, brought about by the motion of iron pieces serving as magnetic conductors. When the flux is due to an exciting coil, the foregoing definition requires constancy of the space relations between the exciting and the induced coils, and in general this constancy of relationship is mechanically expressed by the entire immobility of both coils. It is, however, possible that the inducing coil should turn on its axis without in any way altering its relationship to the induced, and in some cases this is the construction adopted.

As a means of producing electric energy on a large scale, the inductor alternator is the latest claimant for public favor, and yet it is far from being a new-comer. Its advantages have been apparent from the earliest days of the art, and a long series of distinguished inventors have worked at its development. Although until about eight years ago it was an extremely inefficient generator, its extreme simplicity secured it an introduction when not much power was required. Indeed, if we bear in mind that the Bell telephone, considered as a translating device, is an inductor alternator, we shall have to regard the inductor as the most widely used type of alternator. Our concern, here, however, is only with machines useful in large sizes, and any others are of interest only as foreshadowings.

I shall first call your attention to Knight's machine, shown in Fig. 1. This machine was patented in 1854 in England. Its defects are obvious, but it should not be overlooked that it is not worse than its rivals of other types, and, indeed, no worse than most of the modern magnetos for signaling purposes, while it is unquestionably of a more robust construction. Henley's machine, Figs. 2 and 2a, consists of an inducing magnet with an electro-magnet set between its poles and in a plane at right angles to them. A double series of rotating keepers connects first one pole of the electro-magnet to the north pole of the inducing magnet, and the other to the south pole, and then reverses these connections, thus giving rise to an alternating flux through the electro-magnet. Figs. 3 and 4 show an interesting design of Wheatstone's. There is but a single induced coil, within which moves an iron cylinder provided at each end with radial polar extensions. This single coil form has been taken up again by recent inventors, but has not yet come into use. Like Knight's machine, this of Wheatstone suffers from the great variation in the magnetic

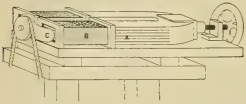
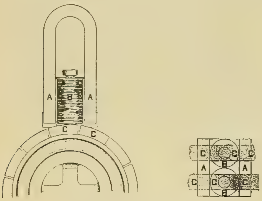
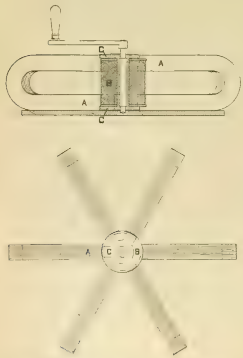


Fig. 1. Knight, 1854. A, Inducing Magnets; B, Induced Coils; C, Rotating Keeper.



Figs. 2 and 2a. Henley, 1856.—A A, Inducing Magnets; B B, Induced Coils; C C, Keepers.



[illegible] A A, Inducing Magnets, B, [illegible] C C, Keepers.

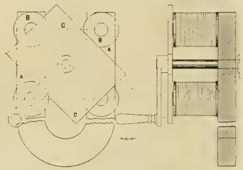


Fig. 5. Wheatstone, 1858.—A A, Inducing Magnet; B B, Induced Coils; C C, Keepers.

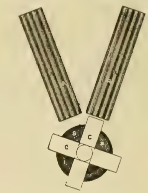
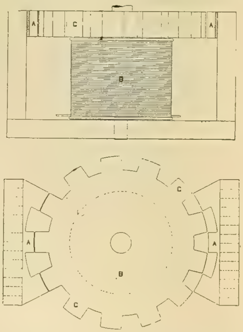
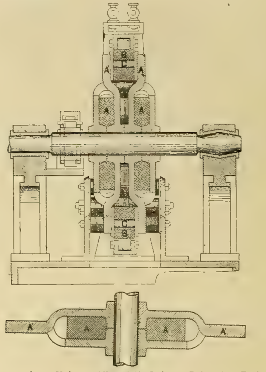


Fig. 6. Lippens.—A A, Inducing Magnets; B B, Induced Coils; C C, Keepers.



Figs. 7 and 8. S. M. Martin, S. A. Varley, 1868. A A, Inductor Poles; B B, Induced Coils; C C, Keepers.



Figs. 9 and 10. Holmes, 1868. A' A', Inductor Poles, A A, Exciting Coils; B B, Induced Coils; C C, Keepers.

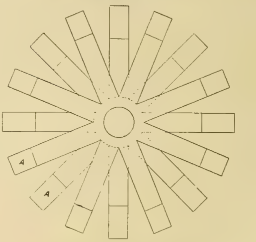


Fig. 11. Holmes, 1868.—A' A', Inductor Poles.

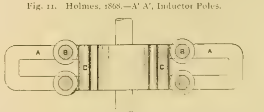


Fig. 12. C. F. Varley, 1877. A A, Inducing Magnets, B B Induced Coils; C C, Keepers.

SOME ACCOUNT OF THE EVOLUTION OF THE INDUCTOR ALTERNATOR

1. Read before the National Electric Light association, New York, May 6, 1896.

2. The almost exclusive reference to English inventors in this paper is not due to underrating the efforts of others, but solely to lack of space and time. It would have been impossible to give adequate recognition to all, and it happened to be more convenient for me to trace the development along English lines until the last stage than along any other. I have no doubt that a parallel history might be written for any of the important cultured lands. At the present time the art of inductor building is more highly developed in the United States and on the European continent than in England. Indeed, a mere mention of the names of the engineers on the continent engaged in the development of inductor machines—Schmann, Dobrowolsky, Arnold, Kolben, Brown and Thury—is sufficient evidence that their work must be of importance.

flux in the inducing magnets. Wheatstone says that the inducing magnets in this machine may be electro magnets. Fig. 5 shows another design of Wheatstone, which shows considerable improvement over the other. The variations of magnetic flux are here confined to those portions of the magnetic circuit in which it is necessary they should occur. The flux as a whole is steady, and the machine operates by its varying distribution, the keeper now directing the flux through one pair of

Fig. 11. C. F. Varley, 1877.—A A, Inducing Magnets; B B, Induced Coils; C C, Keepers.

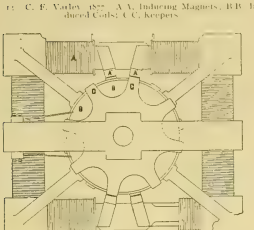


Fig. 14. P. Jablochkoff, 1877.—A', A', Inductor Poles; A, Exciting Coils; B B, Induced Coils; C C, Keeper.

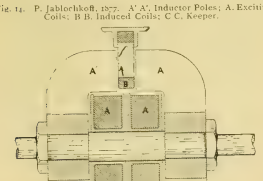


Fig. 15. Mordey, 1887.—A A, Exciting Coils; A' A', Inductor Poles; B B, Induced Coils.

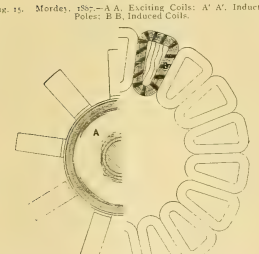


Fig. 16. Mordey, 1887.—A, Exciting Coil; B, Induced Coils.

them, connected to the soft iron yoke. A revolving, toothed iron disk alternately closes the magnetic circuits of the two inducing magnets through the induced magnet. This machine may be considered to be Henley's, with one limb of the electro-magnet suppressed, and only one limb of the inducing magnet in action at a time.

The machine described by Holmes, Figs. 9, 10 and 11, in his English patent of 1868, is worthy of considerable attention. In some respects it may be considered

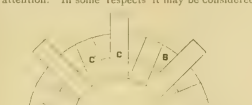


Fig. 17. Mordey, 1888.—B, Induced Coil; C C, Keepers.

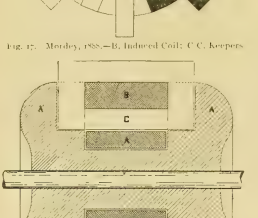


Fig. 18. Mordey, 1888.—A' A', Inductor Poles; A, Exciting Coil; B, Induced Coil; C, Keeper.

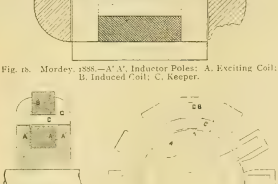


Fig. 19. Mordey, 1889.—A, Exciting Coil; A' A', Inductor Poles; B, Induced Coils; C C, Keepers.



Fig. 20. Mordey, 1889. A, Exciting Coil; A', Inductor Poles; B, Induced Coils; C, Keepers. C', Short Circuit Keepers.

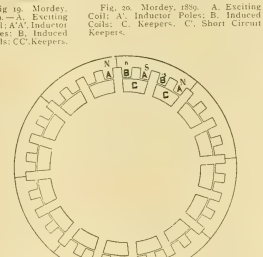


Fig. 21. Kingdon, 1891.—A A, Inductors; B B, Induced Coils; C C, Keepers.

SOME ACCOUNT OF THE EVOLUTION OF THE INDUCTOR ALTERNATOR.

induced coils, now through the other. Wheatstone does not appear to have had this reason in mind in duplicating the induced pair of coils. His object appears to have been to secure a smoother electromotive force curve. This machine was introduced into telegraphy, and I am assured by Stephen D. Field that it gave first-class service. The Lippens machine, shown in Fig. 6, is so like Wheatstone's first design that it needs no description. A machine designed by S. M. Martin and S. A. Varley is shown in Figs. 7 and 8. It consists of two inducing magnets, with an induced magnet between as an inversion of Wheatstone's first design. A single exciting coil gives rise to a number of poles, while the induced electro-magnets are separate and distinct. An interesting feature is that the cores of the induced magnets are slotted to prevent Foucault currents. The exciting coil feature has been adopted in all modern inductors with which I am acquainted, save one, and the subdivision of the iron in armatures to prevent Foucault currents has become a matter of course. Yet, in respect to the steadiness of the flux, this machine is distinctly retrogressive and decidedly inferior to Wheatstone's second design. Holmes intended the machine for electric lighting; but I am not aware of its ever having come into practical use.

Gramme invention came near putting a stop to work on inductors, as, indeed, to work on alternators of any kind. Yet, in the time intervening between the introduction of the Gramme machine and the resurgescence of the alternator, provoked by the introduction of the modern transformer, C. F. Varley designed an inductor, Figs. 12 and 13, which deserves mention for its novelty. The induced coils are subject to the influence of two inducing magnets which tend to develop opposite fluxes through them. These magnets are alternately short-circuited by the keepers; and, in consequence, the flux through the induced coils is alternated. By arranging the keepers so that they begin to short-circuit one inducing magnet before entirely open-circuiting the other, the flux in the inducing magnets is kept more or less constant. In this same year Paul Jablochkoff took out an English patent for an inductor alternator. It is of the single induced-coil type; but were it not for the inventor's great fame, considering the date, it would not be worth attention, Fig. 14.

Even the best of these early inductors must have had vast iron losses. In most cases there was no thought of preventing them, and, when preventive measures were adopted, they were entirely inadequate. The mass of iron subject to magnetic change was always, relatively to the size of the machine, enormous, thus necessarily increasing the hysteresis loss; while no sufficient provision appears to have been made for the prevention of Foucault currents. The machine of Klimenko, exhibited at Vienna, which required more power to drive it when running light than when loaded, was not, I think, exceptional.

In 1887 Mordey cut the Gordian knot by entirely suppressing the iron in the induced portion of the machine. The highly and deservedly successful machine that bears his name is shown in Figs. 15 and 16.

There is a central core surrounded by the exciting coil *A*. From each end of this core project a set of radial polar arms, which are recurved so as almost to meet one another. In the space left free are mounted the thin induced coils *BB* in a circle. The induced coils are wound in the plane of this circle, and are in number twice the polar faces on one side. The induced coils are fixed and the inducing magnet revolves. The exciting coil turns with the core, but this is electrically immaterial, and the results would be the same were it at rest. Obviously, the total reluctance of the magnetic circuit is the same, no matter what the position of the inductor. Change of flux in the iron is due only to armature reaction, and it gives rise to iron losses only because of its space variations. With a low armature reaction, such losses will be extremely small.

Mordey's success, instead of putting an end to attempts to build inductors with iron in the induced portions, gave rise to a new series of efforts. Indeed, Mordey himself was foremost. His English patent of 1887, relating to the coreless armature machine, also described a machine with cores, and in subsequent patents he describes the machines shown in Figs. 17, 18, 19 and 20.

These machines have not come into use, and, presumably, they are not as satisfactory as the coreless machine. Yet they show a marked advance when compared with the older machines. The use of the short-circuiting pieces *C*, as well as the bridges *C*, tends to make the flux constant in amount and to restrict the magnetic changes to the induced portions of the machine. The iron subject to magnetic change is also properly laminated to prevent Foucault currents. The most obvious fault in the designs is that the mass of iron in the induced portions is large, and that all of it is subject to hysteresis loss.

In passing, it may be worth while to note one peculiarity of single induced-coil machines like the earlier of the Mordey designs. With any given frequency, the output is independent of the speed; or, in other words, the only limit to reduction of speed is the possibility of further subdividing the poles. For, with the number of poles increased N times, the total change of flux takes place with 1-Nth the angular motion. This remarkable property may some day bring about the introduction of machines of this class for direct connection to very slow-speed engines.

The Kingdon machine, Fig. 21, is a modernized Henley machine. The exciting and induced coils are wound on the alternate polar projections, and the magnetic connections between the inducing and induced cores are alternately traversed by the rotating keepers *C*. The whole of the iron in the machine appears to be subject to hysteresis loss. Foucault currents are checked in the usual manner by lamination. In this machine, if the induced coils are so wound that they may be worked in parallel, it is possible to reduce the iron losses in proportion to the load by cutting out both inducing and induced coils in the same degree. I hardly think that this advantage is sufficient to countervail, leaving the hysteresis loss too high to begin with. A few of these machines were put into practical use, but I think not many.

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An admirable little book is the "Postal Dictionary," issued by the Matthews-Northrup company of Buffalo. It is an alphabetically arranged hand-book of all information needed by those who use the mails, and the eighth edition is revised and brought down to 1896. Both domestic and foreign mails are very fully treated.

1. The figures of C. F. Varley's machine were made entirely from description. They may be quite different from those on his patent.

# Western Electrician.

EVERY SATURDAY.

PUBLICATION OFFICES:

Suite 510 Marquette Building, CHICAGO.

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EASTERN OFFICE: 108 TIMES BUILDING, NEW YORK.

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**SUBSCRIPTION**, in advance, postage prepaid, $3.00 for a full year of 52 numbers; in clubs of four or more, $2.50, with free extra copy for eight subscriptions; foreign countries, $5.00 a year; single copies, 10 cents. When change of address is requested, the old address as well as the new should be given.

**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, views, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

**ADVERTISING.**—THE WESTERN ELECTRICIAN—**the only general electrical paper published in the West**—thoroughly covers a territory *exclusively its own*. THIS IS A CLAIM WHICH CAN BE MADE BY NO OTHER ELECTRICAL JOURNAL IN THE UNITED STATES. Electrical merchants and manufacturers *desiring western trade* will appreciate the UNEQUALED VALUE of this journal as an advertising medium in its special field. Advertising rates are moderate, and will be furnished on application.

HIGH WATER MARK

CIRCULATION, 16,630.


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THE WESTERN ELECTRICIAN'S first special electric light convention number (dated May 9th) contained 7,576 square inches of advertising. For the same week the *Electrical World* contained 7,326, the *Electrical Engineer* [illegible] *Electrical Review* 3,375 square inches of [illegible]

The W[illegible] advertising therefore exceeded that of the [illegible] by **250** inches, that of the *Engineer* [illegible] **2,889** [illegible] that of the *Review* by **1,201** [illegible] the combined advertising of the [illegible] by **514** inches.

The steady [illegible]

tising in the WESTERN ELECTRICIAN can be shown by a little table well worthy of attention:

| Issue. | Number of Advertising Pages. | Total Number of Pages. | Square Inches of Paid Advertising Matter. |
|---|---|---|---|
| March 3, 1894.... | 40 | 56 | 4,145 |
| February 23, 1895. | 52 | 68 | 5,593 |
| May 9, 1896...... | 72 | 88 | 7,576 |

These figures are carefully and accurately compiled. They illustrate more forcibly than words a steady and vigorous growth during the hard times. It is to be remembered, also, that, in computing the square inches of advertising, all announcements of the WESTERN ELECTRICIAN or the Electrician Publishing company are rigorously excluded, so that the result shows net, *bona fide*, paid advertising. The figures show a growth of 2,000 square inches in a year. They are eloquent and may be left to speak for themselves.

IN the great volume of electrical literature in the English language it is strange that an important opportunity for electrical book making has been neglected. And yet it appears that there is no standard and comprehensive work written in English giving the history of the rise and development of electric lighting, in chronological order, from the earliest experiments to the practice of the present day. Such a history would be very valuable and could be made intensely interesting. Preferably, we think, it should be written from an American point of view as the greatest expansion of the electric light industry has been in the United States, and questions often arise here as to the state of the art at some particular period in the recent past. Such queries could be settled by a reference to a standard history. It may be regarded that the time is not ripe for a history of electric lighting, but unquestionably such a book, if accepted as authoritative, could find a useful place in 1896, and future development might be traced in succeeding and additional volumes.

CANADIAN electricians held a successful meeting at Toronto last week, and, according to the reports presented elsewhere in this issue, materially extended the influence of their organization. Many new members were admitted, and the secretary reported that there were 229 active members at the opening of the convention. Papers were read on interesting topics, a popular lecture was delivered on the Röntgen radiation, and many subjects of practical application to the work of the members were discussed. One result of the meeting which will attract much attention was the establishment of a bureau of statistics under the personal supervision of an officer of the organization. The visitors were given an opportunity to inspect the plant and equipment of the local electric light and street railway companies, and no doubt many of them found valuable suggestions for their own work in these installations. Altogether, the meeting was interesting, instructive and entertaining, and left a pleasant impression upon those who attended.

AT last Milwaukee's street railway boycott, which was begun on May 4th, is ended, although the strike itself has not been declared off, because the national organization would not be bound to give the men who are out any financial assistance if the trouble was officially declared at an end. The local branch of the Amalgamated Association of Street Railway Employes on June 19th announced that the ban had been lifted from the cars and that the friends of the strikers were relieved of all obligation to walk or ride in omnibuses. The bus service of the union has been abandoned, because it could not be made self-sustaining. Thus closes the most unique demonstration in behalf of labor that has been witnessed in the United States. For nearly seven weeks thousands of persons have abstained from riding in street cars out of sympathy for the men who struck. During the first few weeks of the strike there were abundant transportation facilities in the shape of buses, coaches and wagons, but the number of vehicles in service grew less as the weeks passed. The people underwent much discomfort in assisting the strikers, but did it cheerfully, owing to the strong feeling against the syndicate which owns the street car lines in Milwaukee. The result of this strike confirms the opinion that the days of successful labor demonstrations have passed. This does not necessarily mean that the employe is to be worse off than formerly; on the contrary, it is believed that he will be the one most benefited by the new condition of affairs, for the disputes and differences that formerly resulted in lock-outs, with their attendant discomforts and hardships, will now be settled by arbitration. Under the new arrangement the men and the companies will find that their interests will be protected, and this will be conducive to the promotion of a spirit of fairness that could hardly be expected when conflicting interests were working against each other.

SEVERAL years ago Dr. Harper, president of the University of Chicago, in an address before the Chicago Electric club, pledged the university to the establishment of a department of technology, but up to the present time little has been done to fulfill this promise, and consequently there has been a good deal of criticism because of this apparent lack of interest. Now, however, with the acquirement of the Chicago Manual Training School, announcement is made that a department of technology will be established upon a plan in keeping with the university and this department of education. The latest acquisition of the university is expected to be an important feeder to that institution, inasmuch as the Manual Training school has buildings, appurtenances and endowments amounting in value, all told, to more than $250,000, besides which must be taken into account the patronage of the institution. It is to be hoped that the plans of the management to which Dr. Harper has alluded will be speedily put into execution, and that the efforts of those interested in the movement will be crowned with success.

OVER in Michigan there is about as much interest manifested in the question of municipal ownership of lighting plants as in the presidential campaign. This condition of affairs is due in a large measure to the twaddle in which Mayor Pingree of Detroit indulged while stumping the state as a candidate for gubernatorial honors. He told the people that the corporations were robbing them, and he described in graphic terms his thrilling encounter with the "monopolists" who held Detroit in their grasp until he began to run things in that town. A good many of the people who listened to Pingree's ravings believed him, and the politicians were not slow to take advantage of the turn and advocate control of lighting plants by cities and villages. It was unfortunate for the success of this scheme that an experiment had already been made in Marquette, and, although this plant had been held up by the advocates of municipal ownership as an example of the benefits to be derived from this policy, it has lately been shown that the department has been wretchedly mismanaged, that the politicians have secured control and, as might be expected, have made efficient operation of secondary importance to the furtherance of their schemes. The Marquette *Mining Journal*, which, according to its own admission, "has been a consistent and persistent advocate of municipal ownership of water supply and lighting systems," now admits the utter failure of the plan and upbraids the city officials who have squandered the city funds. Speaking of its position on this subject, the *Mining Journal* says editorially that "it has maintained that, with proper management, plants for supplying water and light to urban communities could be depended upon to render a better and cheaper service when owned and operated by the communities thus served than is ordinarily rendered by corporations or firms giving the service under a franchise. But it begins to have some doubts of the soundness of its position in the matter, these being raised by the history of the attempt made in this city to furnish public and private lighting from the electrical plant on the city's Dead river property." A history of the movement in Marquette is then presented, and it is easily seen why the *Mining Journal* "begins to have some doubts." It is the old story of political manipulation. The plant was started out with a blare of trumpets, the people were told that they were saving money, the deception was successful for a time, then the true condition of affairs became apparent and the city was confronted with the proposition of putting in additional money with the hope of saving in part at least the money already invested.

Other cities have had similar experience, and it is only a question of time when every community in the country that is operating its lighting plant will become convinced that this socialistic feature of city government has proved a costly experiment and has encouraged and supported a horde of political heelers who could not secure employment with any commercial company. Detroit will find that it made a sad mistake when it followed the advice of Potato Patch Pingree in electrical matters.

## The Telegraph and the Telephone at the St. Louis Convention.

One of the wonders of the Republican national convention last week was the remarkable facility with which the whole of the United States was furnished information regarding the proceedings of the convention in all its details.

The Postal Telegraph-cable company, having passed through the St. Louis cyclone unscathed, presented a solid front to the surges of words, words, words, from the 400 newspaper correspondents at the convention that sought to overwhelm it; and it was equal to the occasion.

The convention had the effect of hastening construction of several thousand miles of wire. Two large copper wires were strung between Chicago and St. Louis on the recently reconstructed main trunk line; two more were built from Chicago to New York; two between St. Louis and New York via Pittsburg, and an entirely new pole line, with two heavy copper wires, was constructed between Chicago and St. Louis via Decatur. An additional copper wire was also strung between Cleveland and Youngstown, to meet a wire strung from New York.

Arrangements at St Louis were under the immediate supervision of Vice-president E. C. Bradley, assisted by F. W. Jones, electrical engineer, New York; E. J. Nally, assistant general superintendent, Chicago; C. Dougherty, superintendent, St. Louis; J. F. Butterfield, assistant electrical engineer, Chicago.

The Postal has passed through a trial of its capacity that rivals all former conventions. Some of the statistics are of interest. Nearly 3,500,000 words of special matter was sent from St. Louis over its wires, and was handled by the St. Louis force, which had been increased 75 men by accessions from Chicago, Washington, Philadelphia, Kansas City and other points. Nearly all of the Postal's wires are heavy hard-drawn copper, and with a few exceptions were quadruplexed. The majority of the operators sent to St. Louis were code men, and worked at an average speed of 52 words a minute, which is phenomenal on long circuits.

A number of the prominent papers of the larger cities combined and arranged for a bulletin circuit, which was made up from a point on the stage near the speaker, to Chicago; thence to Cleveland, with a branch to Sandusky; thence on to New York; thence to Boston. From Chicago a "leg" extended to Minneapolis. This circuit was named the "Photograph," for over it was sent a complete photographic report of the entire proceedings.

The operator on the stage, Langdon Smith, representing the *New York Herald* and the other papers, besides being an expert telegrapher, is also a newspaper man of large experience. Nothing was reduced to writing. Mr. Smith took in the situation at a glance, and flashed it over the wire. He was not allowed the privilege of a "sounder," which lack was overcome by a special contrivance shaped like a telephone receiver, a small four-ohm specially constructed sounder having been arranged, and so strapped to the ear as to allow the sending operator to hear his own writing in the direst confusion, and the complete manner in which the many papers on the "Photo" circuit were served, proved the great value of the arrangement. Thus the action of the convention in all its kaleidoscopic changes was instantaneously transmitted to the following leading papers of the land: *St. Louis Republic, Chicago Times-Herald, Chicago Tribune, Chicago News, Chicago Journal, Cleveland Press, New York Evening Telegram, New York Herald, Boston Herald, Boston Globe, Minneapolis Tribune, Chicago Evening Post.*

By pre-arrangement, the words "Fire McKinley" were flashed over the wire as a signal of the nomination. By the passing of these words, all on the wire were notified of McKinley's nomination, and a cannon at Canton, Ohio, McKinley's home, was fired.

The Postal served about 60 morning papers and about 40 afternoon publications. At times there were 58 sending circuits in operation out of St. Louis. Large accessions were made to the clerical, messenger and repair force. Extra linemen were stationed a few miles apart on all of the important routes leading out of St. Louis and extending on to New York. Every possible precaution was taken to avoid trouble and expedite the repair of the circuits.

It was impossible, during the rush, for the operators to leave the building, and their meals were served them at their working tables.

At the convention hall the Postal had a conveniently arranged and complete telegraph office. Sixty wires led therefrom, and the 30 loops were placed on direct wires to New York, Boston, Chicago, Philadelphia, Baltimore and other points, thus allowing of direct and instantaneous service. The company was remarkably fortunate in not having a single disarrangement of its wires. While several serious thunder-storms at times slowed down the speed, it was never handicapped.

The strictly Postal feature is the typewritten message, and the specials as received were nearly ready for the compositor, as they were properly spaced, paragraphed, punctuated and edited.

On account of the immense amount of direct work at St. Louis it devolved upon the Chicago office of the company to post the world. On the last day of the convention a bulletin service was used which had served its purpose through several conventions so well that it is worthy of mention.

Two special octette tables were used. On one was the special bulletin wire from St. Louis; on the other was arranged a key and three sounders, placed in resonators of the Postal pattern. As fast as the bulletin wire furnished copy it was passed to an editor, who culled from it the most important items, and then handed the copy to the sending operator, who sat next to him. The latter transmitted it to the three operators sitting at the same table, each of whom, using manifold papers, made 15 copies of the bulletin at one writing. These copies were snatched by four well-trained check boys, who distributed them throughout the main operating room. Thus within a fraction of a minute the news would be in the act of transmission from Boston to San Francisco, and within the minute the countryman in the small town would have the same information that was handed the millionaire of Wall street.

Last Friday, the day following the adjournment of the convention, the Postal Telegraph company gave the visiting operators, to the number of 50, an outing. Three large tally-ho coaches having been placed at the boys' disposal, an enjoyable ride through the parks and boulevards was indulged in.

The long-distance telephone lines, with proper connections, served to connect the convention hall in St. Louis with the home of the leading candidate at Canton, O. The scene in the McKinley homestead on the afternoon of June 18th is thus described:

Major McKinley generally occupied a revolving office chair in front of his closed roll desk, but from time to time he moved about, not exactly in a nervous manner, but as if anxious to see that everything went on all right. He was solicitous that all the news received should be distributed among those on the porch, and as fast as the telegraphic bulletins were handed to him he directed that they be sent outside for their information.

The telephone service was so clear and distinct that Major McKinley and those in the room were enabled to hear, seated at a distance of 600 miles from the convention hall, the shouting and tumult that accompanied the presentation of his name. It was an unprecedented experience in the history of political conventions, and Major McKinley is the first presidential candidate not in attendance upon the convention who heard the noise accompanying his own nomination. The remarkable achievement of thus annihilating time and distance was the theme of conversation, Major McKinley referring to it several times.

At 4:10 o'clock the vote by states began coming over the telephone, and Major McKinley, donning his glasses, amid a silence broken only by the ticking of the telegraph instrument, began scoring the vote by states as fast as it was called.

The Western Union Telegraph company sent from St. Louis 3,860,430 words of special press dispatches in addition to about 500,000 words handled by the press associations. A number of extra circuits and a large force of additional operators were employed.

## The Kelvin Celebration.

Cable advices are to the effect that the celebration of Lord Kelvin's jubilee in Glasgow, last week, was a great success. Congratulatory telegrams were received from all parts of the world. A meeting of New York electricians was held to mark the event, and in response to telegraphic felicitations sent from it, Lord Kelvin sent the following cable message:

Thank you warmly for your kind sympathy with me on the occasion of the jubilee. I wish I were near enough to shake you everyone by the hand and to tell you how much gratified I am that you think of me as a friend and comrade.

On Monday, Professor Loudon of the Toronto University sent a cablegram conveying congratulations of the staff to Lord Kelvin. The following day he received the following reply: "Heartiest thanks for your kind congratulations, which were received and read during the commemoration banquet."

Mr. Ford, the London correspondent, says that the celebration "was a grand tribute to the greatest man of science in England. Nothing was lacking to demonstrate the respect and affection with which he was regarded at home and abroad. All the honors and compliments showered upon him were received by the benignant philosopher with characteristic humility. It was an object lesson in modesty from one of the wisest men of modern times."

## Municipal Lighting in Michigan.

There is one newspaper at least in Michigan that is not deceived by the fallacies of municipal lighting. It is the *Copper Country Journal*, which is published at Calumet, Houghton county. It sounds a note of warning which it would be well for its constituency to bear in mind when deciding the question of municipal ownership:

There is one thing for the taxpayers to keep in mind—the whole body of them would have to bear the expense for the benefit of the few who would use the light, for but few of the taxpayers would be able to bear the expense of wiring their houses for electric lighting, be the cost of the light itself ever so small, particularly as those persons who are renting houses would not be likely to wire another person's house.

The subject of municipal lighting is being pushed just now in Hancock and will, no doubt, if the movement succeeds there, be brought forward in other copper country towns. The *News* thinks that people should go slow and consider well what they are about before taking any decided action in such a matter. In some of the towns where the people were prevailed upon by an array of figures, which sometimes do lie, to put in an electric plant, they have afterward found it necessary, unless the people were satisfied to be in darkness half the time, to put in a duplicate equipment, which was never thought of nor included in the original estimate when the lighting by the municipality was decided upon.

A gentleman from Escanaba informs us that, in order to make a good showing for the action of purchasing an electric light plant, they turn off the lights at midnight, to save expense, and only run the lights on dark nights, while the electric light company here runs the plant all night and every night, dark or not, and this when there are only 20 lights in the streets.

The lighting board of Marquette, after expending $15,000 on work that it was estimated could be completed for less than $10,000, is now endeavoring to secure an extra appropriation of $10,000 to finish the electric plant. In the course of a detailed account of the work on this project the Marquette *Mining Journal*, an "earnest and persistent advocate of municipal ownership," says:

Both the water supply and electric plants here are owned and operated by the city. The experiment of furnishing public and private electric lighting from a plant owned by the municipality was entered on here under the most favorable conditions. The city obtained a manificent water power at a low price seven years ago, and proceeded to improve it for the purpose of furnishing light and power to the city and such private users as might desire the service.

When the new board took charge of the plant there was in the treasury about $7,500 of accrued earnings. With this amount and the estimated earnings for the then pending year, or $10,400 to be precise, Commissioner Pendill, acting as spokesman for the board, assured the council that the power could be improved and 900 additional horse power secured. The council, reluctant at first, was finally persuaded to authorize the work done, and the board lost no time in starting in.

What has been the result? The board soon found that its estimate of the cost of making the projected improvement was entirely too low, and repeatedly came to the council for appropriations to continue the work. It has expended close on $15,000 on the work, while contracts made for the machinery yet to be met, and has a broken dam, a partially built flume, an excavation for a wheel pit and a lot of costly experience to show for that outlay. To put the upper power in condition for use an additional expenditure of not less than $10,000 will probably be required, for much of the work done will have to be torn out if stability is to be secured, and without stability the improvement on which the board has been engaged for the past year will become a menace to the old plant instead of a benefit and source of increased revenue to the city.

The facts here set forth are enough to raise a doubt as to the wisdom of having municipal plants undertake to render service of this kind in the hope of obtaining enduring good results. Certainly if Marquette's lighting plant proves a commercial failure, there is little use of expecting anything better from municipal ownership and operation of such plants in places where the economic conditions are less favorable, for, with the plant here, the power costs nothing and the repairs to the power generating part of it make hardly any showing in the expense of running it, while with a plant both these items count largely against the gross earnings. The *Mining Journal* is disposed to reverse its former opinion and to admit that municipal ownership and control of such plants is a failure.

The mayor of Ishpeming seems to belong to the Pingree class, according to *Iron Ore*. That journal says that "the trouble with the mayor is that he desires to do something to add to his notoriety, and does not know where to begin." In his inaugural, he recommended the adoption of certain measures, which he argued were for the city's good. One of the things suggested was the purchase of an electric lighting plant by the city. This addition would mean the expenditure of anywhere from $50,000 to $100,000, according to the equipment. *Iron Ore* contains some valuable suggestions for the consid-

eration of the chief executive of the municipality. It says: "If the city is paying too much for its lighting, then the council should secure better rates. This would be better than going into the lighting business, probably. First, find out if the city is paying too much, compare the cost with that of other cities, and get some data to work from. This would be better than standing upon the street corners and howling about economy. The mayor, at the last meeting of the council, did not know what the bonded indebtedness of the city was, or when it was due, or was not possessed of any knowledge concerning its financial condition."

## Distribution of Niagara Power at Buffalo.

The Cataract Power & Conduit company of Buffalo has been incorporated, with a capital stock of $2,000,000, to furnish Buffalo with electricity. It is in fact to act as the distributing agent of the Niagara Falls Power company. The Buffalo concern will relieve the parent company of the necessity of a strict supervision of the sale and distribution of electricity in that city. The directors of the new company are Daniel O'Day, E. D. Adams, Francis L. Stetson, Edward L. Wicks, Wm. B. Rankine, D. O. Mills and John Jacob Astor of New York; George Urbane, Jr., and Charles R. Huntley of Buffalo. Mr. Huntley, who is the general manager of the General Electric company of Buffalo, said:

The object of the corporation in a nutshell is to distribute the electric current generated at the Falls throughout Buffalo according to the conditions contained in the franchise and to sell it to anyone and everyone who wants to use it.

You remember by the terms of the franchise granted by the Common Council the company reserved the right to make one assignment of the local privileges therein allowed. This new company will be the one to which these rights and privileges will be assigned. It is formed to carry out the details of the distribution in Buffalo, which the parent company, owing to the magnitude of its interests, does not care to be burdened with. The local company will lay all lines and conduits in the streets and take the power for distribution at the city line. It will attempt to give the business a vigorous activity by every means in its power.

Have your officers been selected?

Not yet. The directors haven't even held a meeting. I cannot say what officials will be chosen or whether or not they will be elected from the board of directors.

Where will your offices be?

I cannot state that either. The work will be carried on according to the demands of the business. This is an unknown quantity, so that our plans are more or less incomplete. The work of laying the conduits will be begun shortly according to the plans and specifications filed by the Cataract Construction company with the board of public works two months since. The main conduits will be laid first, of course, and the smaller streets will be supplied if the demand increases. The first conduit will be laid in Court street.

The parent company is now busy laying its transmission lines to Buffalo. By the terms of the franchise the power must be there by June, 1897. I think there is no doubt that the main distributing conduits in Buffalo will be entirely completed when the electricity is delivered at the city line.

It will be remembered that when the Niagara Falls Power company first started its franchise agitation, one year and a half ago, a syndicate of Buffalo capitalists was formed to buy the power outright from the company at the city line and distribute it throughout the city on its own responsibility, as an independent venture. The company never materialized, and rumor had it at the time that the enterprise was found to involve such an enormous outlay that the Buffalo capitalists decided that they had best draw out while there was yet time.

## Telephone News from the Northwest.

(From the Minneapolis correspondent of the WESTERN ELECTRICIAN.)

Officers of the Central Union Telephone company have been in Des Moines, Ia., recently, and it is thought that they are trying to effect a compromise with the city in the matter of a new franchise, [illegible] present fran[illegible] out next month, [illegible] that drastic regulations may be put in a new one. The company attempted to secure a franchise renewal from the retiring council a few months ago [illegible] last meeting, but the [illegible] coming council prevented it by meeting early in the morning before the old council had a chance to pass an [illegible] regulation, under the state statue which gives telegraph and telephone companies the right to erect and main[illegible] the state [illegible] streets and alleys of [illegible] city form a portion of the public highways of the state.

The North[illegible] company is [illegible]

Work will be begun on a line to Fargo at once. Connection will be made from Minneapolis and St. Paul to Omaha and other Nebraska points. The company held its annual meeting in Minneapolis last week and elected directors and officers. A new exchange will be fitted up at Fifth street and Third avenue south, at a cost of $100,000.

The Wolf River Telephone company of Weyauwega, Wis., and the Oshkosh Northwestern of Oshkosh may connect their systems and operate a toll line and compete with the Wisconsin Telephone company.

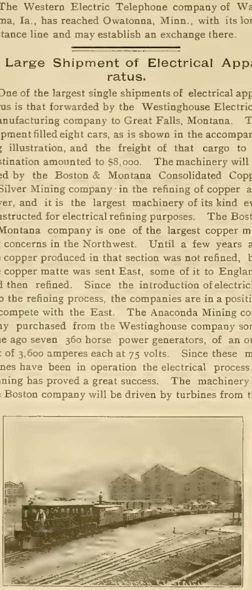
The Harrison Telephone company of Sturgis, S. D., has incorporated with $25,000 capital stock.

The Great Falls & Lewistown Telephone company will extend its line from Mann's Ranch to Neihart, Mont., opening a large number of towns to telephonic communication.

The Western Electric Telephone company of Waucoma, Ia., has reached Owatonna, Minn., with its long-distance line and may establish an exchange there.

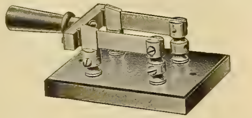
## A Large Shipment of Electrical Apparatus.

One of the largest single shipments of electrical apparatus is that forwarded by the Westinghouse Electric & Manufacturing company to Great Falls, Montana. The shipment filled eight cars, as is shown in the accompanying illustration, and the freight of that cargo to its destination amounted to $8,000. The machinery will be used by the Boston & Montana Consolidated Copper & Silver Mining company in the refining of copper and silver, and it is the largest machinery of its kind ever constructed for electrical refining purposes. The Boston & Montana company is one of the largest copper mining concerns in the Northwest. Until a few years ago the copper produced in that section was not refined, but the copper matte was sent East, some of it to England, and then refined. Since the introduction of electricity into the refining process, the companies are in a position to compete with the East. The Anaconda Mining company purchased from the Westinghouse company some time ago seven 360 horse power generators, of an output of 3,600 amperes each at 75 volts. Since these machines have been in operation the electrical process of refining has proved a great success. The machinery of the Boston company will be driven by turbines from the waters of Great Falls. The generators will be directly connected with the turbines. There are two of them, the largest ever made, each one of 1,100 horse power, at an output of 4,500 amperes and 180 volts. These machines are shipped in four freight cars, while the others are filled with the detail apparatus, such as switchboard appliances.



A LARGE SHIPMENT OF ELECTRICAL APPARATUS.

## Medbery Knife Switch.



MEDBERY KNIFE SWITCH.

The illustration shows one style of the new switches lately put on the market by the Fiberite company, which claims that its unusual facilities for manufacturing enable it to make up the best switch ever presented for the money, and the large sales being made would indicate that the device has peculiar merit. These switches have pure drawn copper blades, black polished slate base, while all the bronze parts are highy polished. Unusual care has been taken to make all connections absolutely correct. The switch, beside being accurate, will make a handsome addition to the finest switchboard. It is made in single, double and triple-pole, single and double-throw, and with or without fuse extensions. A complete stock is carried by the Chicago agent, the Mason Electric Equipment company, 1202 Fisher building.

## The Electric G. P. A.[1]

The trolley cars continue to invade the domain of the steam railways. They carry suburban and interurban passengers alongside the steam roads, they are beginning to transport freight for the farmer and merchant, their white mail cars are doing government service in city streets, and the systems of electric lines have become so extensive and intricate in many cities and the possibilities of developing pleasure travel are so evident, that the establishment of a passenger department for every electric railway company of importance may now be expected. In fact the innovation has already come, for the Brooklyn Rapid Transit company rejoices in a general passenger agent, who has begun to advertise the delights of trolley travel over that extensive system with the zeal and persuasiveness of a veteran G. P. A. The Brooklyn company operates about 130 miles of double track lines, with nearly 100 miles more projected, radiating from the vicinity of the great bridge and the ferries to Bay Ridge, Fort Hamilton, North Beach, Bergen Beach, Jamaica, Flushing and other points on the ocean shore, Long Island Sound and East River, with numerous intersecting lines past the pleasant parks, the peaceful cemeteries and the abodes of city and suburban residents. Running through the streets of an attractive city and reaching numerous charming spots in the woods and by the waters, the Brooklyn lines have many inducements to offer in the way of pleasure travel, while in respect to low fares these roads, like the trolley roads generally, throw the ordinary temptations of the steam roads far into the shade. Under the liberal transfer system the economical tourist can traverse Brooklyn from north to south and east to west—one stretch is 13 miles long—for a single five-cent fare, and the modest sum of eight cents will take him from New York city across the ferry to various seashore resorts. Hear General Passenger Agent Kennedy on this theme:

"By our system of transfers a man may travel from New York city to Ulmer Park, Bergen Beach, North Beach and various other resorts of an equally popular character for eight cents, which includes his passage across the ferry from New York. If he wants to take his wife and child it will cost him less than 25 cents. A trip to Coney Island under the old railroad systems has always meant an expenditure of $1 or more for man, wife and child. It has been an event to look forward to not more than three or four times in a year. Under the advantages offered by our system it is possible for a man of even moderate means to take his family out of town every Sunday. The same advantages are apparent even to people living in Jersey and on Staten Island. One person may travel from Newark, Elizabeth, Hoboken, Jersey City and other New Jersey towns in close touch with the Brooklyn Annex boats and may go all the way to Bergen Beach—or, in fact, any of the other resorts touched by our lines, with the exception of North Beach—for 11 cents. The ride to North Beach will cost five cents extra, though it does not involve a change of cars when once on our system."

But cheapness is not the only attraction. Comfort and social enjoyment in trolley travel are ministered to by special cars—the gaily decorated and brilliantly illuminated open cars which take parties for a summer evening outing through the streets, the "straw party cars," "upholstered with tufts of straw and the floor profusely strewn with the freshest and cleanest straw, which is the only seat;" and the private palace cars, "as luxuriously finished and furnished as any Pullman or Wagner car," in which Brooklynites "delight in being whirled while playing progressive euchre." Nor are these luxurious vehicles beyond the reach of modest purses. It costs only $15 to charter a straw party car for a day or an evening, with rapid transportation thrown in; a decorated and illuminated car can be had for an evening or a day for $20—a cheap lark, when, as the Brooklyn custom is, "the young men chip in for the cost of the cars and the girls bring the lunch;" while the costly palace cars, in blue and gold, fitted with buffets, ice coolers, tables and a piano, and comfortably seating 20 persons, can be chartered for "cards, wedding, dinner or club smoking parties" at the reasonable rate of $20 for exclusive use during morning or afternoon, or $25 for an evening. Moreover, a "porter in livery" accompanies each of these cars which is worth something for style and for opening bottles, even though there are no bags to carry or berths to make up.

Evidently an extensive trolley railway system in any city offers a field for the work of a general passenger department, and the Brooklyn G. P. A. is not likely to be the only one of his kind very long. So amazingly rapid and extended has been the construction of electric roads that every stranger and resident in a large city already feels the need of a map and guide book for his trolley trips, and it is a matter of surprise that the companies have not already done more to encourage travel by the distribution at least of convenient little diagrams of their routes. The day of the electric G. P. A. has come, and his dignified prototype, handling so skillfully the passenger traffic of thousands of miles of road, will need to stir himself to meet the new competition which the fast growing trolley lines are going to offer in short-distance travel. It is less than 10 years since the inception of

1 From the *Railway Age and Northwestern Railroader.*

electric railways, but already there are nearly 15,000 miles of street lines, mostly double track, in operation in the United States and more being added every day.

## Annual Meeting of the Siemens & Halske Electric Company of America.

The annual meeting of the Siemens & Halske Electric company of America was held at Chicago June 20th. A satisfactory showing for the year just closed was made, and the plans for the ensuing year, as outlined, indicated that the company would greatly extend its scope in the immediate future. President Wright withdrew from active direction of the company but consented to serve as director. The stockholders' meeting was followed by a meeting of directors, at which officers for the ensuing year were chosen. C. E. Yerkes was elected president, W. F. Furbeck, vice-president and treasurer, and F. B. Badt was re-elected secretary. W. T. Block was chosen assistant secretary and assistant treasurer. The election of Mr. Yerkes as president and Mr. Furbeck vice-president and treasurer indicates that the company will have the backing of C. T. Yerkes, the Chicago street railway magnate. The newly elected president of the company is a son of C. T. Yerkes, and Mr. Furbeck has been closely associated with the latter and is generally regarded as his confidential adviser. Lieutenant Badt's standing in the electrical fraternity and his familiarity with the business make him an important factor in the present organization.

## Dinner of Electrical Section, Franklin Institute.

The annual dinner of the Electrical Section of the Franklin Institute, Philadelphia, was held at Lincoln Park on Saturday, June 13th. Among the prominent visitors were: John C. Trautwine, chief of the Water Bureau; Authur Falkenau, president Engineers' Club; W. H. Johnson, manager Edison Electric Light company; Russell Hawkins, vice-president Bartram Hotel company; E. A. Custer, chief engineer Harrison Brothers & Co., and Messrs. Zahn and Yunge of the Tudor Storage Battery company of Vienna. The president of the section, Clayton W. Pike, acted as toastmaster, and responses were made by ex-President Carl Hering, Vice-president Thomas Spenser and William C. L. Eglin, Paul Foster Leach, F. Uhlenhaupt, Jr., Dr. A. E. Kennelly and others

## Mr. Hobart Interested in Electrical Enterprises.

It will interest the electrical fraternity to know that Garret A. Hobart, the Republican candidate for vice-president, is largely interested in electrical enterprises. It is said that years ago he foresaw the future in store for electricity as a motive power and an illuminant, and he confidently put money into trolley and electric light companies. He is a resident of Paterson, N. J., and is a director of the Edison Electric Illuminating company of that city.

## Cable Code Regulations.

The international telegraph convention at Budapest on June 18th took up the question of the compulsory use of the official vocabulary for code messages. The resolutions of the New York Chamber of Commerce and other bodies opposing the vocabulary were presented by the representatives of the Commercial Cable company, and the convention decided that the vocabulary shall not be made compulsory, and all future action be indefinitely postponed.

## Conference on Rules.

Official announcement is made that the conference on standard electrical rules which met in New York on March 18th and 19th will not hold a meeting in June, as was contemplated at the first meeting. The committee on rules had not completed its report, and the proposed June meeting is therefore deferred until a later date, probably in the autumn, of which due announcement will be made whenever a time is decided upon.

## Forbrich Allen.

On June 17th Charles W. Forbrich, a highly esteemed member of the business staff of the WESTERN ELECTRICIAN, was united in marriage to Miss Rovilla F. Allen, at the home of the bride's parents, Mr. and Mrs. C. W. Allen, in Berwick, Ill. Mr. and Mrs. Forbrich are spending a few weeks in Northern Wisconsin, but will be "at home" to their friends in Chicago after August 1st. The WESTERN ELECTRICIAN extends to them its heartiest congratulations.

## Social Aspect of the Trolley Party.

The first trolley party of the season has been rolled over the tracks of Chicago and the suburbs, and the indications are that this mild dissipation will find much popular favor during the summer. Only a little stimulus is required to give the practice all the enthusiasm of a "fad." It has the entertaining elements that attract all classes of society, comparatively rapid motion, sociability and a constantly changing panorama of outside effects. Even the streets that would be regarded as most objectionable for pedestrianism become interesting when viewed from a fast moving car. The objective points in all cases, however, would be the outlying districts, where the air is untainted by the smoke of the city and Nature has had a chance to make a show of its summer decorations. To the poorer dwellers of the city, who have scant opportunities to get away from their dull and oppressive environment, to whom a bicycle purchase is an impossible luxury, and whose "society," therefore, is confined to neighborhood stoops, or whose usual outings go no farther than neighborhood vacant lots, the cheapness of the "trolley party" provides a positive boon to their monotonous lives.

The interest, however, is not confined to those to whom it is a luxury, but is shared by people who can afford more of the luxuries of life, but who find much diversion a change from a different kind of monotony. In other cities where the "trolley party" has become a recognized summer institution, notably Philadelphia, it has been found that the devotees were confined to no one walk of life. The rich and poor share the pleasure if from widely opposite reasons. Each is free from any intrusions, and there is little more security in this respect inside a house. An abuse has cropped up, however, in other places which it would be well for Chicagoans to guard against in advance. The fact that the form of amusement is practically within the reach of all has led to outbreaks of rowdyism and boisterous conduct that tended to bring the trolley party into disrepute. It was an abuse that crept in insidiously and grew so fast that it was formidable before the attention of the authorities was brought to it. No such outbreak must be permitted here. The first attempts of rowdies to pervert the honest and wholesome amusement to vicious purposes must be suppressed with so much vigor that future imitations will be discouraged. The trolley party has come, and it should stay, and it must keep its fair name. *Chicago Tribune.*

## Death in an Electric Light Station.

An interesting story comes from Rochester, N. Y., about a peculiar fatality in a local electric lighting station. The facts here presented are taken from a daily newspaper:

Charles Hilliard, 35 years of age, an employe of the Citizens' Light & Power company, met a sudden and peculiar death Sunday morning, June 21st. He was at work in the company's plant at the foot of Factory street and was walking around a switchboard when he suddenly fell to the floor. Some men who were standing near him saw him fall and rushed to where he lay on the floor. All of the methods of resuscitation which the electrical workers are instructed to employ in cases where a person receives a severe shock were tried, but without avail. The man never recovered consciousness after he fell and death finally resulted.

No one on the floor where Hilliard was working saw him come in contact with any of the electric wires and some of the officers of the company are inclined to believe that the man's death was due to heart disease. Near where he was working there were several wires each carrying 2,200 volts of alternating current. The strange part of the matter is that there is not a mark on the body that would in any probability have been caused by the electric current. There is a slight mark on the left elbow, but as this is in the nature of a bruise, it is thought that it was caused when the man fell to the floor.

Hilliard has been in the employ of the company for about a year and a half. He came here from Toronto two years ago. He had no relatives in the city. His family lives in Toronto. He began work with the company as a lineman, but latterly was accustomed to do general work about the plant. For the last two weeks he had been working nights.

Saturday night he was working on the dynamo floor. There are three switches near where he was working, but the middle one was out of order and the current was shut off.

At a few minutes after 6 o'clock in the morning Hilliard and Assistant Engineer Woodlock were at work on this switch and had about completed the job when Woodlock left his guard to walk around back of the switchboard and push a wire through to him.

Hilliard started back, but had taken only a few steps when he fell forward on his arms and knees. His elbows rested on the floor and he remained in this position until some of the other employes ran to him and picked him up.

A few minutes before Hilliard fell on the floor he walked over to a corner of the room and drank two glasses of icewater. It was quite warm in the room. Hilliard was working and as Hilliard was a large, fleshy man, it was thought that the sudden change in his temperature might have something to do with his condition.

He was carried outside and the men at once began to work on him. All of the men in the employ of the company are informed as to what course to pursue in case anyone comes in contact with a live wire and is rendered unconscious. While one employe telephoned for a doctor the others began to work over the unconscious man.

Superintendent J. A. Almstead was called and everything possible was done for Hilliard. But after two physicians and the employes of the company had labored with him for over two hours the task was abandoned and the man expired.

Until the result of an autopsy is made known, the cause of the man's death will be a mystery.

# CORRESPONDENCE.

## New York Notes.

NEW YORK, June 20.—Harrison J. Smith of the Edison Electric Illuminating company of this city died on Tuesday. I detailed the sad accident which resulted in his fatal injury in my last letter. Mr. Smith was 42 years of age and leaves a widow, two sons and a daughter. The following sketch of his career, prepared by his company, tells the story of an interesting and worthy life:

During his early life Mr. Smith worked as a carpenter in the Pullman car shops, and subsequently as a machinist on engine construction. He also fired a locomotive for a short time. In 1881 house carpenters were advertised for by the Edison Electric Illuminating company of New York in connection with the construction of the historic Edison station in Pearl street, and Mr. Smith, with a few others, was engaged. He continued with the company as carpenter and machinist until 1883, and, after an interim of a month, entered the meter department and subsequently became its head. He left the company for about a year to engage in the wiring business, but returned in October, 1885, as electrician of the Pearl street station under Mr. Chinnock, and subsequently became superintendent of the first district. Later on he was appointed general operating superintendent of the company, which position he occupied at the time of his death.

As one result of the murder of President Wyckoff of the Bank of New Amsterdam for refusing an insane man's demand for $6,000, an enterprising electrical man is taking advantage of the opportunity to exploit what he regards as a simple and effective means of protection from the assaults of crazed and desperate individuals who threaten life if large sums of money are not paid to them on the spot. The safeguard which he has proposed and which is being brought to the attention of bankers and others is simply a push-button to be placed underfoot beneath the carpet at the desk in the private office. When a crank enters, all that is necessary is to press the button and those in the outer office are expected to do the rest.

A dispatch from Albany yesterday gave information of the filing of incorporation papers of the New York Telephone company, with a capital of $16,000,000, divided into 160,000 shares. The new company proposes to operate all over New York city and extend to Brooklyn, Staten Island, Long Island City, Montauk Point, Albany, Boston, Philadelphia and intermediate points in New York, Massachusetts, Rhode Island, Connecticut and New Jersey. The directors, who hold 10 shares of stock each, are: George J. Gould, Lakewood, N. J.; Charles F. Cutler, Morris, N. J.; John H. Cahill, Joseph P. Davis, Thomas T. Eckert, William J. Bouchelle, James Merrihew and William H. Wolverton, New York city; Charles A. Tinker and John Jameson, Brooklyn; William A. Forbes and John E. Hudson, Boston; John Van Horne, Bayonne, N. J. This is an imposing array of telegraph and telephone men, and the news of incorporation has excited much interest. It is said that a reorganization of the Metropolitan company is intended. W. F. O.

## Washington, D. C.

WASHINGTON, June 20.—Royce & Marean, dealers in general electrical supplies, have just completed a contract of putting in an electrical plant in the big Christian Heurich brewery located on the square bounded by C, D, Twenty-fourth and Twenty-fifth streets, northwest. They put in about six miles of wire and about 800 lamps. Power is furnished by a 350 horse power Harrisburg Ideal engine. Another and larger engine, of about double the capacity, will be put in later to furnish motive power.

The Bliss School of Electricity, a Washington institution, treated the citizens to a novel display on a recent evening. Prof. Louis D. Bliss, the principal of the school, determined to do something novel for the commencement exercises of the institution, and accordingly chartered two of the Ninth street trains of the Metropolitan Railroad company for the occasion. The students then took charge of them and decorated them with numerous electrical devices. They placed an electric symbol on the front of the first train instead of a headlight, and on all sides gleamed electrical devices, the work of the graduates. At the top of each car was a star and along the sides were the words "Bliss School

of Electricity." The diplomas were presented to the graduates by Prof. Bliss, he passing through the cars and presenting them to each one in turn. One feature of the trip was the tickets, which were made out in electrical vernacular, and also time-tables giving a list of attractions along the line. There were 38 graduates, and about 150 altogether took the trip.

Outside of the usual demand for standard supplies, the dealers in electrical goods report trade rather dull. The fan trade so far has only had about a month to get in its work, and is flat at present, owing to the prevailing cool spell. This constitutes about the bulk of the trade until buildings which are at present in course of erection are completed sufficiently to allow electric work to be begun. There are several "plums" of this sort which are not as yet ready to pull.

The Treasury Department, through the supervising architect's office, is inviting proposals until June 19th for furnishing all labor and material and erecting complete one electric passenger elevator for the United States court house and postoffice building at Springfield, Ill.

The authorities are very strict about overhead electric wires. Henry T. Purdy, superintendent of the Potomac Electric Light company, was lately arrested for stringing an overhead wire for furnishing current for an electric light system in a private dwelling. The case was continued indefinitely.

The passage by the House of the Senate bill requiring the Eckington & Soldiers' Home Railway company to adopt rapid transit on its lines is causing considerable jubilation among residents of the neighborhoods to be affected by the change. This company formerly had a trolley system, but it was taken up by order of the commissioners, and since then it has been operating horse cars.

The Washington Electric club, organized "to further mutual improvement, instruction in electrical and other forms of study, and to demonstrate the deeper problems," has been organized. The president is M. O. Spring, and Arthur E. Yundt is secretary.

The Metropolitan Railroad company of Baltimore, a recently incorporated institution, with a capital stock of $2,000,000, will operate its railroads with the underground electric system now used on the Metropolitan railroad of this city.

The amendment to the sundry civil bill for the appropriation of a sufficient sum for lighting the capitol grounds by electricity has been agreed to in conference, and the work is to be begun immediately after Congress adjourns. This is a much needed improvement and the state of the building and grounds has for a long time been a reproach to Congress. The matter has been agitated for years, and at last the antiquated system will be done away with and modern methods substituted. Several representatives advocate the placing of various colored electric globes on the outside of the dome. This recommendation is under advisement. The gas jets on each post in the grounds will be superseded by incandescent arc lights, and it is estimated that altogether there will be 125 arc lights on the terrace and in the grounds, this will increase the light about 500 per cent. Arrangements will be made whereby the grounds can be made almost as light as day on special occasions. Four or five arc lights will be placed in the thotus of the dome, where at present the light is produced by a spiral of gas jets. A powerful reflector will be placed behind each of them, and thus each one will be a searchlight. Some of the gas lights on the east front of the building will be replaced by arc lights in opal globes, and the whole effect will be striking. The west front and all of the walks will also be provided with lamps. The interior of the building will be completely lighted with incandescent lamps. It is expected that the contract will be let soon after July 1st, and the successful bidders will be required to complete the work by the middle of November in order to give the electricians at the office a chance to test the plant. Another dynamo and engine capable of carrying 3,500 lights will be placed on the Senate side, and all the dynamos will be so arranged that they may be worked as one plant, two plants or separately. T. I. P.

## Northwestern Notations.

MINNEAPOLIS, June 20.—The Dunlap (Ia.) Electric Light & Power company will put in a $25,000 electric light plant.

Electric lights are being considered at Chatfield, Minn.

The DeWitt (Ia.) Electric Light company awarded the contract for electrical equipment for its plant to the General Electric company.

Le Sueur, Minn., will have its electric light plant completed by September 1st. The old company refuses to move its poles and wires from the streets, but proposes to fight. The town is too small to support two electric light companies.

Fosston, Minn., will vote on June 30th on $10,000 bonds for an electric light and water plant.

Great Falls, Mont., has an electric light war in prospect. The Great Falls Electric Light company offered to furnish light for $120 per light per year on a three-year contract or $114 on a five-year contract. C. F. Cowan of Butte and C. N. Atkinson of Havre offered to furnish light for $100 per light per year on a five-year contract. An ordinance was introduced granting a franchise to the latter. C.

## PERSONAL.

Louis A. Ferguson of the Chicago Edison company, who sustained a painful injury while bicycle riding two weeks ago, is rapidly recovering and hopes to resume his duties in the course of a week.

Word was received in this city last week of the death of M. J. Sullivan at Washington on June 12th. Mr. Sullivan had not been in good health for some time, but his friends were not prepared for the announcement of his death. Appendicitis was the cause. Mr. Sullivan had been engaged in electrical pursuits in Chicago and New York. For several years he was employed by the Edison General Electric company. Later he was interested in the publication of the *Street Railway Gazette* and afterward was in charge of the Chicago office of the *Electrical World*. Mr. Sullivan's wife survives him.

## ELECTRIC LIGHTING.

The Vicksburg, Mich., council has ordered another election on the electric light question, the courts declaring the last one irregular.

A proposition has been made by several prominent Charlestown citizens to illuminate Bunker Hill monument with electricity. A local paper is urging this innovation as desirable, but the idea seems to meet with little popular favor.

This item is floating about in the daily papers: The houses of parliament are partly lighted by 40,000 electric lamps, which number is being constantly increased. Fifty expert electricians are employed to keep the system in order. But there is still a yearly gas bill of over $10,000.

## ELECTRIC RAILWAYS.

The Trade and Labor Assembly of Chicago has adopted resolutions urging the Common Council to grant no more privileges for overhead wires, and urging all quasi-public bodies to agitate the placing underground of all charged electric wires and also "demanding" that the proper authorities compel the street car companies to properly safeguard the front of all electric and cable cars.

Since the opening of the present season, and especially during the last few days, the Niagara Falls Park & River railroad, the electric line which runs from Queenston to Chippewa on the Canadian side of the Niagara river, has been doing a big business. On Saturday, June 13th, it carried a large excursion from Mono Road and Orangeville, the Canadian Order of Foresters, and also did a large business from other sources. On Sunday it entertained the Knickerbocker Bicycle Club of Toronto, which had been domiciled at the Queen's Royal prior to its opening. The railway company has a fine equipment and visitors at the Falls are afforded an excellent opportunity to view the scenery at this point.

The City Council of Chicago has passed an ordinance declaring that "No surface railroad now operated by steam power shall hereafter operate the same by electric power, either by the overhead contact system or otherwise, within the city of Chicago, without first obtaining authority and permission therefor from the City Council of the city of Chicago. No railroad corporation or company operating a surface railroad shall erect any poles or string wires thereon along, upon or across any public street, alley, highway, or other public place in the city of Chicago for the purpose of conveying an electric current to operate its railroad cars, unless it has obtained permission and authority from the City Council of the city of Chicago for that purpose."

The increase of $4,500,000 in the capital stock of the Calumet Electric Street Railway, authorized at the annual meeting held recently, has occasioned not a little talk, according to a daily paper. The officers are reticent as to the object of the increase. Some people think it means a branching out by the company on a still larger scale. The fact is that the Calumet Electric is pushing its lines with energy. The company was incorporated May 17, 1890, with a capital of $50,000, the organizers being Nathaniel K Fairbank, Joel D. Harvey, S E Gross, W V Jacobs and O S Gaither. The company acquired an ordinance from the village of Hyde Park authorizing the construction of a street railroad, this ordinance being supplemented by others. One passed last November authorized the building of 28 miles of road, and those lines are now being constructed. In October, 1895, the Calumet Electric leased the property of the Englewood & Chicago Street Railway company, consisting of lines on South Chicago avenue, Vernon avenue, Vincennes avenue and Sixty-seventh street. The lease runs for five years. The Calumet Electric has now about 80 miles of single track electric lines. Its power house is at Ninety-fourth street and Drexel avenue. The capital stock of the company was increased in October, 1890, from $50,000 to $500,000, and now to $5,000,000. Of an authorized issue of $3,000,000 bonds, there is outstanding $2,500,000.

## TELEPHONE.

The report of the directors of the New England Telephone & Telegraph company of Boston for 1895 shows a gross revenue of $2,430,102.07 and a net revenue of $557,773.59—an increase in net revenue of $59,311.09 over 1894. The expenditure for new construction during the year amounted to $501,448.40, of which $102,809.97 was for exchange aerial construction, $197,486.27 for underground work, $95,769.45 for equipment and $105,382.71 for toll lines. The total mileage of exchange wire on December 31st was 54,109 miles and the number of employes 1,250.

The Erie Telegraph & Telephone company has been considering the question of authorizing an issue of new collateral bonds not exceeding $4,000,000. These bonds will be 30-year five per cent. securities, and will be secured by a mortgage of the shares in the capital stock of the other companies owned by the Erie people. President Sprague of the Erie company, in explaining the purpose of the new issue, says: "The large demand for telephone extensions and the rapid growth of the business necessitates the increasing of the capital stock of the three sub-companies in which this company owns a controlling interest. To obtain funds to purchase the proportionate amount of the new stock allotted to this company it is necessary to issue bonds. The directors have deemed it wise to make provision for the future and have authorized an issue of $4,000,000."

One of the largest contracts for telephones ever made in the United States was concluded recently between Burt Hubbell, secretary of the Keystone Telephone company of Pittsburg, and Colonel J. S. James, president of the Atlanta Telephone company of Atlanta, Ga. The contract, according to a Pittsburg paper, includes the furnishing of 10,000 telephone instruments at a cost of $300,000. The Atlanta company is a strong and independent anti-Bell company, and already it has contracted with 2,800 subscribers in Atlanta to use its instruments for five years at an annual rental of $36 per year. It guarantees to take 10,000 telephone instruments within a year, and expects to have 7,000 patrons within six months. The American Bell company has but 1,400 subscribers in Atlanta and charges a uniform rate of $84 per year. Colonel James, who is United States district attorney of Northern Georgia, will carry the war against the Bell monopoly throughout the South, and the people are flocking to the standard of the independent movement.

At the recent annual meeting of the stockholders of the Harrison International Telephone company the following named directors for the coming year were elected: R. C. Brownell, S. T. Kimball, James H. Vallaugh, H. S. Smith, J. L. Wilson, George M. Peal, Charles H. Gray, R. C. Kerens, C. B. Kimball, D. H. Champlin and L. E. Ingalls. The directors subsequently elected the following named officers: L. E. Ingalls, president; H. S. Smith, vice-president; S. T. Kimball, secretary. The reports of the directors and officials showed a good increase in the company's business during the last year. Among other things, it was stated that a contract had recently been entered into with the construction company by which the latter is to pay the parent company a royalty of $1 for every telephone manufactured. The relation of the construction company to the parent company may be inferred when it is stated that the officers of the two are practically the same. In the last two years the Harrison company has sold about 20,000 telephones, and President Ingalls stated at the meeting that there were contracts ahead which called for 15,000 more. The Harrison Telephone company was organized a few years ago with a capital stock of $80,000,000, but at the meeting last year this was reduced to $40,000,000.

## TELEGRAPH.

At the annual meeting of shareholders of the Central & South American Telegraph company and the Mexican Telegraph company, the following named gentlemen were re-elected directors for the ensuing year: Directors of the Central & South American Telegraph company, Edward D. Adams, George S. Bowdoin, William R. Grace, William Gaston Hamilton, Charles Lanier, J. Pierpont Morgan, T. Jefferson Coolidge, James Alfred Roosevelt and James A Scrymser. Directors of the Mexican Telegraph company, John E. Alexandre, Edmund L. Baylies, William Gaston Hamilton, Charles H. Marshall, J. Pierpont Morgan, Percy R. Pyne, Wm. Walter Phelps, Roosevelt, James A. Scrymser and George G. Williams. Both enterprises are controlled by New York capitalists, with headquarters at 17 Wall street.

## ELECTRIC MINING.

A few months ago the interesting power transmission plant installed by the General Electric company at the Silver Lake mines of E. G. Stoiber at Silverton, Colo., was described. The introduction of electricity into the operation of the mines has resulted in economy so noticeable that an increase in the plant is now being made to provide for an extension of the system in the mines and to reinforce the water power which is not

sufficient to furnish all the power required throughout the year. Two cross-compound Corliss engines, with cylinders 23 by 36 by 48 inches, each engine of 850 indicated horse power, are now being set up, together with water tube boilers, mechanical stokers, coal and ash conveyors, feed-water heaters, separators, water meter, coal weighers, the whole making what will be the most thoroughly modern steam plant in the state. The difference between the cost of coal at the power house and its cost at the mine, which is at greater elevation by some 2,500 feet, is such that the saving effected, even when steam power is used for generating purposes, will insure an ample return on the investment, while the economy induced by the use of the water power is considerably greater. Mr. Stoiber, therefore, feels that in adopting electricity for the operation of his mines he has more than considerably diminished the cost of working them. The present plant consists of two 150 kilowatt three phase water driven generators, supplying current to one 100 horse power motor for the mill, one 100 horse power motor for the air compressor, one 75 horse power motor for the hoist, one 15 horse power motor for the pump, one of one horse power for a blower and to incandescent lights scattered throughout the station, mill and mine. The additional plant will consist of two 150 kilowatt General Electric generators, one 200 horse power motor for the mill, one 15 horse power motor to drive a pump, and two 10 horse power for blowers, forges and miscellaneous machinery. And to eventually utilize to the full the capacity of the steam and water power plant, additional and larger generators will be set up. Not the least interesting feature of this installation is that, although the entire output of electrical energy is to be used in the operation of a single mining property, it will be, when completed, the largest electric power plant in the state of Colorado.

## POWER TRANSMISSION.

The first test of power transmission from the Sierras to Fresno, Cal., was made recently, at the new substation of the San Joaquin Electric company. The lighting test was made a few days ago. The power test proved even more satisfactory than the lighting test, and the directors of the new enterprise are delighted. The source of power is 35 miles from Fresno in an air line, and 1,200 horse power can be utilized. The trial was made with one of the big pumps at the city water works, close to the sub-station, and with 75 horse power the pump worked most satisfactorily. The electric connections are nearly complete, and part of the city will in a few days be lighted with power from the Sierras.

The Lachine rapids of the St. Lawrence are at last to be utilized. For some time past work has been carried on by the Lachine Rapids Hydraulic company upon a large wing dam which runs out for more than a thousand feet into the St. Lawrence river. A fall of water is secured by means of this dam, sufficient to develop at the low water season 15,000 horse power. This water power is to be transformed into electricity. Upon the dam a power house will be built which will run its entire length and show an unbroken interior of 1,000 feet long. The basement of this will be occupied by the water wheels from the Stilwell-Bierce & Smith-Vaile works at Dayton, Ohio. The main floor will contain the dynamos, of which there will be 12, each of 1,000 horse power, or 12,000 horse power in all. These machines will be of the General Electric company's latest multiphase type, and will generate current for transmission to Montreal for use there in lighting the city, operating the street railroads and other lighting and power purposes. Apart from the fact that this plant will exceed in interest any yet installed, the contract for this electrical installation is the largest ever placed at one time, it is said, for electric dynamos. It is also worthy of note that, although it was completed for by every prominent electrical manufacturer in the world, the superiority of the American apparatus kept the order with home manufacturers.

## MISCELLANEOUS.

The Thompson Electric company's works at Waterford, Ont., were destroyed by fire June 19th, entailing a loss of $30,000.

The 1896-97 announcement of the College of Engineering, Metallurgy and the Mechanic Arts of the University of Minnesota is out and will be sent on application.

The stockholders of the Westinghouse Electric & Manufacturing company have voted affirmatively upon the proposition to increase the stock from $10,000,000 to $15,000,000.

A local paper says that a mine of pure mica has been discovered on the mountains near Cranberry Creek, a few miles from Gloversville, N. Y. The mica appears to be in "pockets."

The engineering annuals from the technical colleges are being sent out. The WESTERN ELECTRICIAN acknowledges the receipt of *The Technic* from the University of Michigan and *The Technograph* from the University of Illinois.

This sad romance is printed by the daily newspapers as a news item from New York under date of June 21st: "A year ago Charles Fennelley and Louise Costello, who were engaged to marry, separated after a lovers' quarrel. To-day they met for the first time since their differences and renewed their vows. They then started for a walk through Van Courtland's Park. At four o'clock a severe storm came up and they took shelter beneath a large tree. A few moments later a shaft of lightning struck the tree. The young man was killed instantly and the girl so badly injured that she will probably die."

A striking instance of foolhardiness followed by death is told in a press dispatch from Toledo. Louis David, 21 years of age, was instantly killed this morning (June 21st) by grasping the dangling end of a live electric wire. A police officer noticed crossed wires burning in a tree on Field avenue, and, after notifying the traction company, stood guard to warn passers-by. David made a derisive remark and caught hold of the wire, meeting instant death.

The Municipal Assembly of St. Louis has passed a bill to abolish the overhead electric wires. The bill requires all wires to go underground by July 1, 1900, except the messenger call, clock, burglar alarm and wires of that character, which are not strung on poles and insulated. The bill further provides that the franchises of the syndicate which builds the conduits shall expire in 1940, and that 5 per cent. of the gross receipts must be paid to the city. It puts the construction of conduits under the control of the Board of Public Improvements and reserves the right for the city to buy the conduits at the expiration of 15 years.

The steam yacht Hiawatha, owned by Charles Fleischman of the New York Yacht Club, was launched from the yard of her builders, Seabury & Co., just before midnight recently, according to the *New York Herald*, the water serving best at that time. The yacht was in holiday attire of flags and streamers, while Japanese lanterns were strung from bowsprit to masthead and throughout the rigging, presenting a pretty picture. The electric display was brilliant, two searchlights being arranged on the yards, while numerous arc lights were on either side of the ways. The result was that the white hull of the yacht was quite as sharply defined as in daylight. Miss Annie Fleischman, a niece of the owner, christened the Hiawatha.

A scheme for making electricity more available to the public for general purposes has been proposed by T. Meacock. Mr. Meacock says that the time has arrived when electricity, now only available, in general, in towns, should be in reach of residents in suburban and rural districts. As a means of carrying out this idea, he proposes to establish, he terms electrical colonization, or a grouping of, say, a dozen residences, having a common generating station, with attendant, which should supply the current for the residences in the group, saying that the plant could be at the service of the subscribers for pumping water, for charging storage batteries for electrically propelled carriages, for heating, cooking and many other purposes. The supply could be extended to an electric launch, if there was a sheet of water in the vicinity, and, where it was possible, provision could without difficulty be made for supplying a current for operating electric elevators. Mr. Meacock believes that such a scheme could be put into practice by an enterprising builder or capitalist with excellent chance of financial success.

A communication to an English paper, giving an account of the practical working of the electric welding process in a shop doing a wide variety of machine forging and repairing, says: "We find the electric welding very useful in cases of breakdown. Not long ago we had a two-inch countershaft broken, and it caused about 20 hands to cease work for a week or right again. We took the shaft down, stripped the pulleys from it, pieced it up again in one of our welders, and had the men working again in less than 30 minutes. One advantage this system has over the ordinary forge welding is that there is no waste of metal. We can take two pieces of, say, 1½-inch round (iron or steel), saw them each exactly 12 inches long, and when they are welded together and swaged to size they are just 24 inches long. If a steam engine connecting rod broke we could piece it up exactly the length (without the usual way of making two piecings) and keep it up to the diameter. It would need very little labor in polishing it up again, as every piecing only blackens it about one inch on either side of the weld. We have also welded together boiler plates and similar jobs by placing the cold rivet in position, applying the current to it, and, when sufficiently heated, riveting it up in the usual way."

An electric light-ship is being built in Portland, Ore., for the station at Umatilla Reef. It is to be a composite vessel, of steel and wood, the framing being of steel and the casing of wood, copper bottomed. To prevent galvanic action in the hull, it is constructed as follows: First, an inner planking four inches thick is fastened to the steel hull by galvanized bolts and washers. These bolts are sunk into the four-inch planking and plugged over. A layer of felt is then put on top of the four-inch planking, and outside of this there is another layer of oak planking 1½ inches in thickness, this latter being fastened to the inside planking by composition bolts. This oak planking is then sheathed with copper plates. The dimensions of the vessel are: Length, 112 feet; beam, 28½ feet; draft, 13 feet. It will be fitted with a propeller engine capable of giving a speed of nine miles per hour. This will be used in the case of storms to relieve the strain on the anchor chains by going ahead slowly, and also to propel the vessel in case a storm should ever make it necessary to raise the anchor and leave the station. The ship will have an electric light plant with all the machinery in duplicate for furnishing four 1,000 candle power arc lights at the top of each of the two masts at a height of 54 feet from the deck. There will also be provided a fog signal, consisting of a 12-inch whistle of the chime class, giving the first, third and fifth notes of the scale. The whistle will be blown either by steam or by compressed air.

## TRADE NEWS.

Clift Wire, general contractor for electric railways, paving and underground conduit, has removed to room 2 Manhattan building, Chicago.

The Charter Gas Engine company of Sterling, Ill., makes gas and gasoline engines that have many meritorious features. These engines are extremely simple in construction and are claimed to be absolutely safe. A descriptive catalogue is sent on application.

Manager Charles E. Coleman of the Chicago branch of Eugene Munsell & Co., and also of the Mica Insulator company, Chicago, left this week on an extended trip throughout the West and Northwest. Mr. Coleman will visit Salt Lake City and Denver, and touch at numerous other points in his extensive territory.

The store of W. H. Sills & Co., dealers in mica at 57 and 59 Lake street, Chicago, was closed by a deputy sheriff on June 17th on judgments as follows: E. B. Felsenthal $550, Walter G. Neuhoff, $770, Hamilton & Russell Manufacturing company, $1,050.14; Josephine A. Sills, $2,200, Chicago & North Carolina Mica company, $1,420.

President A. D. Scott of the Scott Engineering company of St. Louis visited Chicago last week. Mr. Scott is now establishing a Chicago branch for his company. The Scott company found that its business was growing so rapidly that this expansion was necessary in order to take care of northeastern business. The company, although a general engineering concern, is making a specialty of electrical work, and is meeting with much success. The exact location of the company's offices is not yet stated.

## BUSINESS.

The Rollins Engine company of Nashua, N. H., presents "A Handful of Trumps" to all users of steam engines when it sends around its arguments in pamphlet form. Indicator cards and testimonial letters show the efficiency of the Rollins engine.

The General Electric company has purchased the stock of the Southern Electrical Manufacturing & Supply company of New Orleans, La., and has succeeded to the business thereof. The General Electric company will increase the stock of the Southern company and will extend the business in every way possible.

The Electric Appliance company is carrying in Chicago a well-assorted stock of Electra carbons, and is prepared to fill orders from manufacturers' prices. It claims that the Electra carbon is the cleanest imported carbon on the market, burning with the least possible amount of dust, hence giving a longer life than would otherwise be possible.

The Stow Manufacturing company of Binghamton, N. Y., has just issued a new catalogue (No. 6), profusely illustrated, showing its large line of portable drills with flexible shaft and electric motors. The last three months have been exceedingly busy ones with this concern, especially in the sale of electric portable street railway drilling plants, which bid fair to be used by all the street railways of the country, so rapidly are they being purchased. Secretary W. C. Hawes of this company has seen this company grow, under his skillful management, to its present importance in the trade, and he can justly be proud of its success.

The Mica Insulator company of 218 Water street, New York, is sending out samples of flexible micanite which reveal a fine quality of plate for insulation. This material is made from the finest mica. It is especially recommended as an insulator for armature slots, armature bodies, field magnet coils, etc. Its extreme flexibility will allow it to be bent into any shape desired. It is furnished in sheets 36 by 36 inches, and of any thickness desired, from ⅛ of an inch upward. The demand for micanite specialties is on the increase, both here and in Europe, and the London and Schenectady factories are kept busy filling orders.

The career of the Adams-Bagnall Electric company of Cleveland seems to be a series of business successes. Only a few weeks ago the company was awarded the contract for 750 series arc lamps at $22.50, for the West Side parks, Chicago, after the most careful consideration and the hottest kind of competition. And now comes the information to the effect that within the last 5 days contracts have been closed in Detroit for 100 arc lamps and in Canton, O., for 100 lamps, the Adams-Bagnall company being highest bidder in both cases. General Manager L. H. Rogers and E. J. Bagnall of the company were in Chicago last week and they stated that the "A.-B." company has on hand orders for from 1,200 to 1,300 lamps. Such a record as this speaks for itself as to the merits of the "A.-B." lamp and the enterprise of the men behind it.

A number of World's Fair diploma and medal winners among the electrical and allied interests in Chicago are just now beginning to give vent in a mild sort of way to long suppressed enthusiasm over the knowledge of their distinction. The cause of the flutter is merely that, having almost given up hope of seeing the medals or diplomas before 1900, their arrival at this time convinces them that their faith, although somewhat strained, was not misplaced. Bowers Bros., for instance, were last week astonished by the expressman, and really have good reason to be pleased, as the award in this case was for "large size," "pureness," "transparency" and "superior quality of mica." Mr. Bowers knew all this before, as did his many good customers, but he is pleased nevertheless that it has received official certification before the great exposition had been almost forgotten.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued June 16, 1896.*

561,958. Automatic Electric Switch. William S. Barstow, Brooklyn, N. Y., and Robert Lindsay, Cleveland, Ohio. Application filed June 5, 1895.

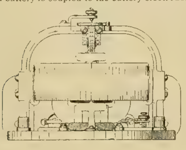
Notched disks or cams are driven by the shaft of a motor, a switch-arm controlling the continuity of an electric circuit and movable upon its support, a spring for moving the switch-arm, and stops controlled by the movement of the disks for determining the position of the switch-arm.

561,970. Electric Railway Switch. William R. Daggett, Dayton, Ohio. Application filed November 30, 1895.

In an electric switch for street railways, the combination with a switch of electro-magnets on the outside of the switch, an armature between the electro-magnets and connected to the switch, flanged rollers upon which the armature rests and is guided, wires in the path of the trolley wheels, and adapted to convey current from the trolley wires to the electro-magnets.

561,975. Electro-galvanic Belt. Alonzo Dow, Wooster, Ohio. Application filed February 17, 1896.

Body electrodes are fitted to one side of the belt, battery electrodes are attached to the opposite side of the belt and electrically connected with their respective body electrodes, and a battery is coupled to the battery electrodes.



NO. 561,977.

561,977. Electrical Energy Indicator. Thomas Duncan, Fort Wayne, Ind. Application filed November 11, 1895.

The combination with an electric energy indicator, of a movable wound armature, a commutator, and the elastic brushes for neutralizing any vibration imparted to them.

561,982. Electrical Pilot or Signal. Henry H. Franklin, Brooklyn, N. Y. Application filed March 18, 1896.

An electrical alarm system adapted for use on board a vessel and for determining the depth of water consists of a casing which is suspended by a cable, through which pass two conductors, the casing being provided with a shaft which passes centrally therethrough, and with an arm connected therewith which is adapted to complete the circuit through the conductors, the shaft being provided at each end with arms, to which is secured a pendulum, which is adapted to come in contact with the ground.

561,991. Trolley. John H. Holland and Peter F. Glazier, Indianapolis, Ind. Application filed August 23, 1895.

One feature is a trolley head in two sections, divided horizontally and pivoted together so as to form a swivel construction and having ball-bearings between the meeting faces of the sections, and having removable bearing-plates at contact with the balls, both above and below the balls.

562,004. Telegraphy. Edward FitzGerald Law, London, England. Application filed January 8, 1895.

Claim is made for the combination of a main line connecting rotating arms at separated stations, a series of insulated segmental contacts in the path of rotation of each arm, and a device at one station for changing the circumferential position of the insulated segments with respect to the position of the rotating arm, which consists of a rotatable table, upon which the insulated segments are fixed and a device for moving the table.

562,009. Telephone Switchboard. George S. Maxwell, Richmond, Va. Application filed March 17, 1896.

Switching cords and loops are adapted to engage the levers and a magneto-generator is provided, having terminals adjacent to the loops when hung upon the levers, whereby a little movement of a loop when so hung will connect one of the terminals with a lever for the purpose of energizing the line to sound a signal.

562,010. Telephone Switchboard. George S Maxwell, Richmond, Va. Application filed March 17, 1896.

The invention consists of a drop and a spring-jack on a subscriber's line and a switch connected therewith.

562,011. Telephone System. George S Maxwell, Richmond, Va. Application filed March 17, 1896.

The arrangement [illegible] annunciator and a telephone [illegible] hinge a telephone instrument at [illegible] ground wire therefor, a [illegible] for the instrument and annunciator [illegible] the instrument and re[illegible] the instrument with [illegible] the call wire.

562,012. Telephone Switchboard. George S Maxwell, Richmond, Va. Application filed March 20, 1896.

The [illegible] combination of a table carrying [illegible] connecting plugs and a board [illegible] the board and table [illegible]

562,013. Telephone System. George S. Maxwell, Richmond, Va. Application filed March 25, 1896.

[illegible] in combination [illegible] connected in series with [illegible] generator, bell [illegible] brought in [illegible] out [illegible] changing device is [illegible]

[illegible] Richard P. Osgood, Salem, Mass. Application filed September [illegible] 1895.

[illegible] and cover in [illegible] upper cup [illegible] provided with openings [illegible] suspended [illegible] between the poles.

562,034. Fire Alarm Signal Box. John J. Ruddick, Newton, Mass. Application filed October 8, 1894.

The combination is claimed of the motor and break-wheel, and a starting and stopping lever therefor, with an electro-magnet and armature, a latch to catch the armature when retracted, and a locking-lever operated by the break-wheel and engaging with the armature and latch, and a re-starting device co-operating with the stopping and starting lever and with the armature.

562,055. Rail Bond or Connection. Harlan P. Wellman, Catlettsburg, Ky. Application filed July 9, 1895.

A bond-wire or connection consisting of iron or steel terminals, and a copper rod or bar joining the same and electrically welded thereto with a gradual welding or fusion of the one metal into the other.

562,062. Regulating Alternating Motors. Albert H. Armstrong, Schenectady, N. Y. Application filed January 11, 1896.

An induction motor having a revolving and stationary part with a ratio of transformation other than one to one, and a switch adapted to interchange the terminals of the revolving and stationary parts.

562,064. System of Telephonic Exchange. Salomon Berditschewsky (called Apostoloff), London, England. Application filed March 23, 1896.

This is an automatic telephone exchange system, wherein the members of each subscriber's line, the switches in which they terminate and the contacts on which the switches normally rest and over which they are traversed are connected in groups differently formed for the positive and negative members, the combination with each switch-carrier of a screw-spindle mounted to rotate, and of electro-magnetically operated mechanism adapted to impart step-by-step rotary motion to the screw-spindle, the switch-carrier being formed as a nut adapted to be traversed upon the screw-spindle when it is revolved by the electro-magnetic propelment mechanism for traversing the switch over the corresponding row of contacts.

562,090. Electric Arc Lamp. Moses S. Okun, New York, N. Y. Application filed April 8, 1892.

The combination of a magnet coil having an iron ring and a central bore, with a carbon-holding rod and levers or arms within the bore to hold the rod.

562,097. Device for Removing Insulation from Electric Wires. Adolph E. O. Rieckel, Brooklyn, N. Y. Application filed December 13, 1895.

The device comprises two pivoted handle levers and a blade held in one and a wing on the other, which wing has a longitudinal and a transverse groove crossing each other at right angles in the upper surface of the wing, and rollers mounted in slots of the longitudinal groove.

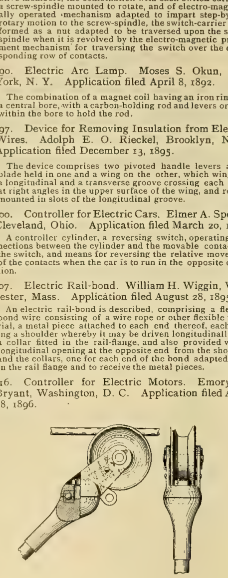
562,100. Controller for Electric Cars. Elmer A. Sperry, Cleveland, Ohio. Application filed March 20, 1896.

A controller cylinder, a reversing switch, operating connections between the cylinder and the movable contacts of the switch, and means for reversing the relative movement of the contacts when the car is to run in the opposite direction.

562,107. Electric Rail-bond. William H. Wiggin, Worcester, Mass. Application filed August 28, 1895.

An electric rail-bond is described, comprising a flexible bond wire consisting of a wire rope or other flexible material, a metal piece attached to each end thereof, each having a shoulder whereby it may be driven longitudinally into a collar fitted in the rail-flange, and also provided with a longitudinal opening at the opposite end from the shoulder and the collars, one for each end of the bond adapted to fit in the rail flange and to receive the metal pieces.

562,116. Controller for Electric Motors. Emory A. Bryant, Washington, D. C. Application filed April 18, 1896.



NO. 561,991.

The first claim follows: In combination with a suitable resistance coil or device, a treadle or lever provided with a contact arranged to vary the resistance included in circuit as the lever is rocked, and a reversing switch carried by the lever and adapted to be actuated by a lateral movement of the foot or limb of the operator without rocking the treadle.

562,118. Emergency Electric Brake. Benjamin F. Card, Brooklyn, N. Y. Application filed February 6, 1896.

An emergency electric brake for street cars is described, consisting of the combination of an electro-magnet, brake-shoes for the wheels, levers for operating the brake-shoes, an armature for the magnet, and ball bearings between the levers and bars which are elastically connected to the armature.

562,132. Trolley for Electric Railways. Martin T. Graf, Buffalo, N. Y. Application filed January 14, 1896.

A grooved trolley wheel is provided in the bottom of its groove with a filling or bearing surface of softer material than the body of the wheel.

562,142. Electric Switch. James F. McElroy, Albany, N Y Application filed December 29, 1894.

A cylinder principally composed of insulating matter carries a connecting plug at one end in permanent electrical connection with a source of electrical supply through the axle thereof, brushes arranged to receive electricity from the plug, and secondary plug in the periphery thereof adapted to electrically connect corresponding brushes, one of which is electrically connected with one of the first named brushes.

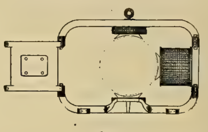
562,166. Insulator. Thomas Blankinsop and Joseph W. Brown, Martin's Ferry, Ohio. Application filed March 24, 1896.

A head is formed with a wire-engaging groove, and a screw-stem joins the head by a shoulder, and is reinforced by an embedded metal plug or core extending above the shoulder into the head.

562,179. Dynamo-electric Machine and Electric Motor. John G. Germann and Frederick B. Downing, Erie, Pa. Application filed March 26, 1896.

Claim one is given: In a motor or dynamo, the combination with the armature of the field magnet core having its shoe in proper relation to the armature, and a support for said field magnet core hinged off the center of said shoe to allow the free movement of the field magnet core and coil away from the armature, and having the axis of the hinge in a plane substantially at right angles to the axis of the armature.

562,208. Safety Lamp. William Waegel, Philadelphia, Pa. Application filed October 22, 1895.



NO. 562,179.

The claim: In a device of the character described, an incandescent lamp, a casing by which said lamp is surrounded and hermetically sealed, a valve through which said casing may be filled with an extinguishing gas, a valve adapted to be closed upon its seat by means of said gas, a spring carried by said valve and adapted to close the electric circuit when said valve is closed, and break said circuit when said valve is open, and the spring adapted to open the valve when the pressure in the casing is relieved.

562,209. Electric Distributing System. Richard R. Bowker, Brooklyn, N. Y. Application filed February 27, 1896.

The features mentioned are a supply station, a network of street conductors receiving current therefrom, and controllable switch-boxes interposed in series in the street conductors, and a controlling circuit including the actuating apparatus of the switch-boxes and operated from the station, whereby when the switch-boxes are controlled to break circuit a portion of the network of conductors may be electrically cut off from the supply station.

562,216. Electric Railway System, etc. Carl Coerper, Cologne, Germany. Application filed April 4, 1896.

An electric railway system is described, consisting of primary conductors, overlapping secondary conductors, transformers interposed between the main and secondary conductors, and magneto-electric switch devices, by which the primary windings of the transformers are automatically switched in as soon as the contacts on the car connect the overlapping portions of two adjacent conductors parallel with each other, and by which the primary windings of the transformers are likewise automatically cut out as soon as no further current is required on the adjacent secondary conductors.

562,253. Automatic Block System. Judson Shoecraft, Harveyville, Kans. Application filed August 8, 1895.

This arrangement is provided with a signal shaft adapted to be revolved, a stopping lever for the shaft, and a spring motor adapted to engage when expanded the lever when the motor is nearly run down to stop the signal shaft at the "danger" position.

562,304. Diaphragm for Electrolytic Purposes. Martin Kiliani, Neuhausen, Switzerland, Walther Rathenau, Berlin, Germany, and Carl Suter, Neuhausen, Switzerland. Application filed August 15, 1894.

This is an electrolytic diaphragm in the form of a vessel constructed with a series of inner steadying laths, bars or rods, a permeable membrane placed against the inner series, a series of outer steadying laths, bars or rods placed against the membrane, and two parallel end frames for supporting the inner system of laths, bars or rods.

562,313. Electric Arc Lamp. Oliver S. Lyford, Jr., Chicago, Ill. Application filed April 6, 1896.

An inclosing chamber for the carbon electrodes is normally sealed from the external air, and a porous or fibrous diaphragm is provided for securing the equalization of any substantial difference between the external and internal pressures upon the walls of the inclosing chamber.

562,318. Railway Signal. Frank McBrien, Newark, N. J. Application filed April 1, 1896.

A railway signal system comprising a plurality of track sections insulated from one another, a plurality of signal devices, a motor for operating each signal device, a neutral and a polar relay at each signal station controlled by a track circuit common to both, and an operating circuit for the motor including two circuit-closers controlled by the two relays.

562,325. Electric Burglar Alarm. Henry Rohrdantz, Buffalo, N. Y. Application filed January 30, 1896.

One claim is given: The combination of a motor, circuit wires connected thereto, one wire being insulated therefrom, spring-arm extended from the insulated wire, roller on the extremity of said arm, and a circuit-closer adapted to be rotated by the motor and to contact with roller, which projects slightly in its path, the roller serving to pass the circuit-closer by slight deflection of the spring-arm without stopping the motor.

562,356. Trolley Wire Switch. Sylvanus D. Cushman, Akron, Ohio. Application filed February 25, 1896.

This device has line and switch-wire terminals, and a rocking tongue to bring either switch terminal in alignment with the main terminal, clasps on the terminals to fasten them to the wires, and studs to support the wires on either side.

Institute of Technology
Boston Mass.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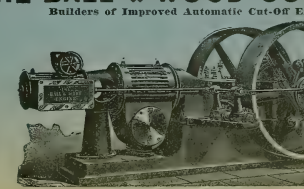

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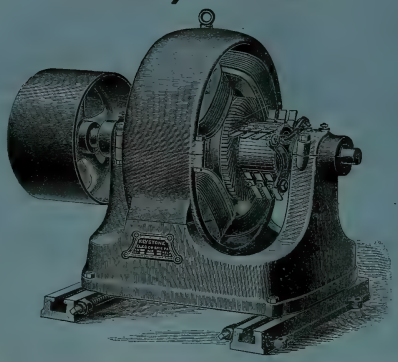

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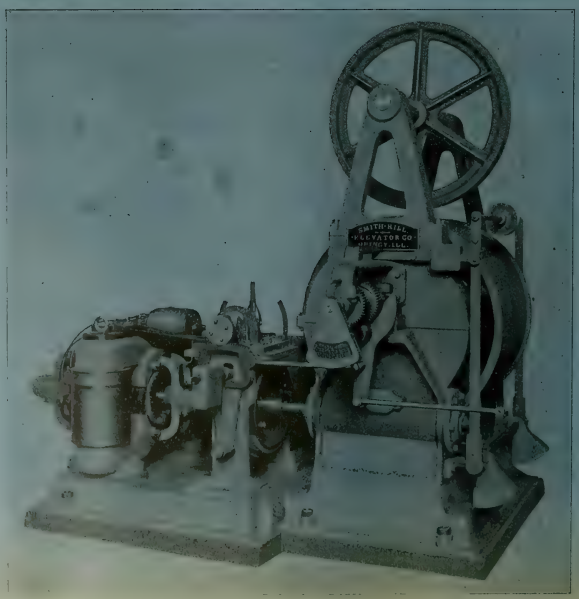

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Butler Hard Rubber Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Storage Battery Co.
Gordon-Burnham Bat. Co.
Kester Elec. Mfg. Co.
Leclanche Battery Co., The.
Mason, J. W.
Menominee El. & Mech. Co.
Newton Rubber Wks.
Ohio Storage Battery Co.
Partrick & Carter Co.
Western Electric Co.

**Bells.**
Central Electric Co.
Electric Appliance Co.
Menominee El. & Mech. Co.
National Electric Co.
Ostrander & Co., W. R.
Partrick & Carter Co.
Western Electric Co.

**Belting.**
Chicago Belting Co.
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Moyes, L. M.
Murray Iron Works Co.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm.Co., Ltd.

**Brushes.**
Bernardin, F. M.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Holmes Fibre-Graphite Co.
Kester Elec. Mfg. Co.
Mason, J. W.
Partridge Carbon Co.
Solar Carbon & Mfg. Co.
Wirt, Chas.
Younglove & Gere.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Menominee El. & Mech. Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
Morse, S. F. B.
New York Ins. Wire Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C.Co.
Western Electric Co.

**Carbons, Points & Plates.**
Bernardin, F. M.
Central Electric Co.
Chicago Gen'l Fixture Co.
General Electric Co.
Hardtmuth & Co., F.
Mason, J. W.
Partridge Carbon Co.
Reisinger, Hugo.
Solar Carbon & Mfg. Co.
Wertheim, Ed.
Western Electric Co.

**Cigar Lighters.**
National Electric Co.

**Compound.**
Kester Elec. Mfg. Co.

**Conduits.**
Am. Circular Loom Co.
Central Electric Co.
Interior Conduit & Ins. Co.
McRoy, Jno. T.

**Construction & Repairs.**
Bernardin, F. M.
Ft. Wayne Elec. Corporation.
Homer & Co., F. E.
Richards & Meacham.

**Contractors and Electric Light Plants.**
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
Card Electric Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Gates Elec. Mfg. Co.
General Electric Co.
Kester Electric Co.
Keystone Electric Co.
Interior Conduit & Ins. Co.
Perkins, Frank C.
Schott, W. H.
Siemens & Halske Elec. Co.
Standard Electric Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas. H.

**Copper Wires.**
American Electrical Works.
Bernardin, F. M.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Menominee El. & Mech. Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Bernardin, F. M.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Commercial Elec. Sup. Co.
Electric Appliance Co
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co
Fiberite Co., The.
Locke, F. M.
Mason, J. W.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bernardin, F. M.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec Sup. Co.
Eddy Elec. Mfg Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Kester Electric Co.
Louisville Elec. Wks.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Nuttall Co., R. D.
Partrick & Carter Co.

**Desk Lights.**
McLeod, Ward & Co.

**Desks.**
Ithaca Desk Co.

**Dynamos.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Gates Elec. Mfg. Co.
General Electric Co.
Interior Conduit & Ins. Co.
Kester Electric Co.
Keystone Electric Co.
Michigan Electric Co.
Roth Bros. & Co.
Siemens & Halske Elec. Co.
Standard Electric Co.
Walker Mfg. Co.
Westinghouse Elec. & Mfg. Co.

**Economizers.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H.
Eddy Elec. Mfg. Co.
Perkins, Frank C.
Schott, W. H.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bernardin, F. M.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
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Brixey, W. R.
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Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
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Partrick & Carter Co.

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Besly & Co., Chas. H.
Nuttall Co., R. D.

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Bernardin, F. M.
Besly & Co., Chas. H.
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Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Interior Conduit & Ins. Co.
Louisville Elec. Wks.
MacCurdy & Smith.
Mason, J. W.
McLeod, Ward & Co.
Menominee El. & Mech. Co.
Metropolitan Electric Co.
National Electric Co.
Partrick & Carter Co.
Queen & Co. Inc.
Sioux City Brass Works.
S. K. C. Specialty Co.
Standard Tel. & Elec. Co.

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**Gov nors, Water Wheel.**
Lombard Water Wheel Gv. Co.

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Dixon Crucible Co., Jos
Holmes Fibre-Graphite Co.

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Fiberite Co., The.
Newton Rubber Wks.

**Heating, Electric.**
Bowen, W. J.

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Anderson, Albert & J. M.
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Bernardin, F. M.
Brixey, W. R.
Butler Hard Rubber Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Locke, Fred M.
Louisville Elec. Wks.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C.Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
Morse, S. F. B.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.

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Inglis, Wm.

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Am. Electrical Mfg. Co.
Beacon Lamp Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
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Ft. Wayne Elec. Corporation.
General Electric Co.
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New York & Ohio Co.
Partrick & Carter Co.
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Bliss Co., E. W.
Harrington, Son & Co., E.
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Munsell & Co. Eugene.
Schoonmaker, A. O.

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Independent Electric Co.
Westinghouse El. & Mfg. Co.

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Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec Mfg. Co.
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Ft. Wayne Elec. Corporation.
Gates Elec. Mfg. Co.
General Electric Co.
Interior Conduit & Ins. Co.
Kester Electric Co.
Keystone Electric Co.
Menominee El. & Mech. Co.
Michigan Elec. Co.
Roth Bros. & Co.
Sioux City Brass Works.
Standard Electric Co.
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Storey Motor & Tool Co.
Walker Mfg. Co.
Westinghouse El. & Mfg. Co.

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Garlock Packing Co.
Peerless Rubber Mfg. Co.

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MacCurdy & Smith.

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Phosphor Bronze Sm.Co Ltd.

**Platinum.**
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Hart, C. S.
Lewis, A. L. & Co.
Lindsley Bros.
Morris, Tasker & Co.
Nuttall Co., R. D.
Pendleton & Gilkey.

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Empire China Works.
General Electric Co.
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Electric Appliance Co.
National Electric Co.
Partrick & Carter Co.

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General Electric Co.
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Iron Clad Rheostat Co.

**Sal Ammoniac.**
Klipstein & Co., A.

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Electric Appliance Co.
Ostrander & Co., W. R.
Partrick & Carter Co.

**Speed Indicators.**
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Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
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Electric Storage Battery Co.
Ohio Storage Battery Co.

**Street Cars.**
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**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
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Berliner Telephone Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Farr Tel. & Const. Supply Co
Gustafson, W. A.
Keystone Telephone Co.
Mason J. W.
Richards & Meacham.
Sill, A. D.
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U. S. Tel. Const. Co.
Viaduct Mfg. Co.
Western Electric Co.
Western Tel. Const. Co.
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Ft. Wayne Elec. Corporation
General Electric Co.
Louisville Elec. Wks.
Stanley Electric Mfg. Co.

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Bernardin, F. M.
Samson Cordage Wks.

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Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

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Int. Corr. Schools.

**Water Wheels.**
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
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Represent the highest degree of perfection in Electrical Machinery. During the Holiday time, when the load is heaviest, our friend the Waxahachie Electric Light Company, of Texas, takes time to write us how pleased he is with the Dynamo, and the same mail brings a like letter from The Piedmont Pulp & Paper Company of Piedmont, W. Va. Speaking of paper mills reminds us that all the mills of the Louis Snider's Sons Company of Hamilton, Ohio, use Kester Dynamos. And the City Railway Company of Galveston, Texas, as well as the Electric Light Company of Sault Ste. Marie, Mich., express themselves as well pleased with the Kester Machines. From Buffalo and New York City westward to the thriving little city of Astoria, Oregon, you will find the Kester Machines. The Water-works of Atlanta, Ga., as well as our friend at San Cristobal, Los Andes, Venezuela (who writes in Spanish), all express the same degree of satisfaction. And all this because the Kester has distinguishing features of superiority which convince every purchaser, no matter what his nationality or politics.

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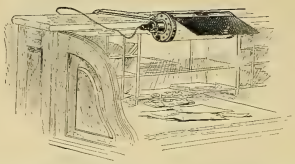

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Long Life, Efficiency,
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It is Absolutely Non Freezing,
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Strong and Light,
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Will illuminate the S. S. St. Louis and St. Paul, furnished by dynamos having 360 amperes capacity each.

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OR SOMETHING WORSE THAN NOTHING ?
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WILL THE FINANCIAL QUESTION BE "SETTLED ?"
WILL CUBA WIN OUT ?
WILL ECONOMICAL LONG-DISTANCE TRANSMISSION BE ACCOMPLISHED?
WILL THE MONROE DOCTRINE BE UPHELD ?
WILL THE ARMENIANS BE PROTECTED?
WHO WILL BE NEXT PRESIDENT?
WILL COL. INGERSOLL BE "CONVERTED?"
WILL THE ELECTRICAL BUSINESS IMPROVE?
IS ACETYLENE A FAKE?
IS THE WELSBACH BURNER A COMPETITOR?
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| Best System of Wiring? | **INTERIOR CONDUIT!** |
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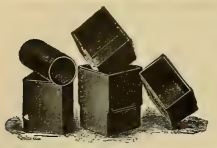
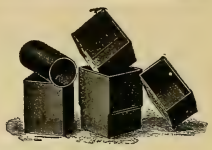


# THE FREEMAN



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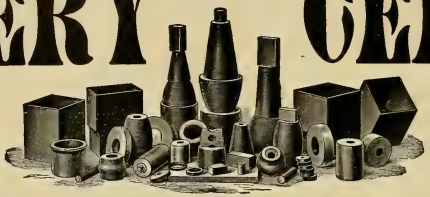

Standard Sizes Always on Hand.

The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished, providing additional strength to such an extent that this cell can be used where no other would be practical.

## THESE CELLS ARE A NEW PRODUCTION AND FULLY GUARANTEED.

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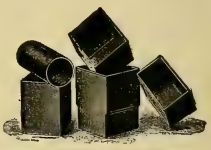

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New Face Plate.

## BETTER PROPORTIONS. BETTER FINISH. MORE DURABLE.

Made of solid plate brass $\frac{1}{8}$-inch thick, with beveled edges.

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Better Material,

Self-Adjusting Handle,
No Breaking,

No Binding on Face Plates,
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Handles, Switches and Face Plates Interchangeable.

Single Plates for all sizes of Hart Switches.
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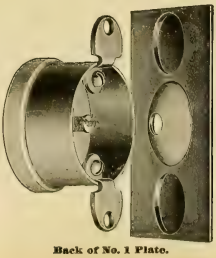

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IRON CLAD
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IRON CLAD
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# Iron Clad Rheostat Company,

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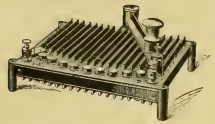
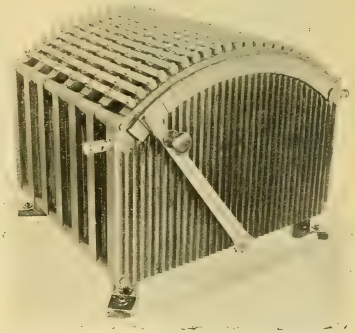


## Motor Speed Regulating Rheostats

**For regulating the speed of motors under full load. To be used in circuit continuously on any step. Heavy special "double-contact" steps on large sizes.**

| Cat'l'gue No. | H. P. | Length Inches | Width Inches | Depth Inches | No. of Steps | Maximum Amperes 125 V lts | 250 V lts | 500 V lts | List Price |
|---|---|---|---|---|---|---|---|---|---|
| 201 | ¼ | 5½ | 5½ | 2 | 7 | 1.5 | | | $ 8.00 |
| 202 | ½ | 8½ | 8 | 2 | 9 | 3 | .5 | 1 | 10.00 |
| 203 | ¾ | 11 | 10½ | 2½ | 11 | 6 | 3 | 1.5 | 13.00 |
| 204 | 1 | 11 | 10½ | 2½ | 11 | 10 | 6 | 3 | 18.00 |
| 205 | 2 | 13 | 12 | 2½ | 13 | 18 | 10 | 5 | 23.00 |
| 206 | 3 | 13 | 12 | 2½ | 13 | 25 | 14 | 7 | 27.00 |
| 207 | 5 | 13 | 12 | 5 | 13 | 40 | 20 | 10 | 45.00 |
| 208 | 7½ | 13 | 12 | 5 | 13 | 60 | 30 | 15 | 60.00 |
| 209 | 10 | 20 | 15 | 6 | 20 | 80 | 40 | 20 | 80.00 |
| 210 | 12 | 20 | 15 | 6 | 20 | 96 | 48 | 24 | 86.00 |
| 211 | 15 | 20 | 15 | 6 | 20 | 120 | 60 | 30 | 95.00 |
| 212 | 8 | 20 | 15 | 9 | 20 | 144 | 72 | 36 | 110.00 |
| 213 | 20 | 20 | 15 | 9 | 20 | 160 | 80 | 40 | 120.00 |
| 214 | 25 | 20 | 15 | 12 | 20 | 200 | 100 | 50 | 145.00 |
| 215 | 30 | 20 | 15 | 15 | 20 | 240 | 120 | 60 | 173.00 |
| 216 | 40 | 20 | 15 | 18 | 20 | 320 | 160 | 80 | 227.00 |
| 217 | 50 | 20 | 15 | 21 | 20 | 400 | 200 | 100 | 269.00 |



50 H. P. 500 Volt Motor Speed Regulating Rheostat.

**Prices Subject to our regular TRADE DISCOUNT.**

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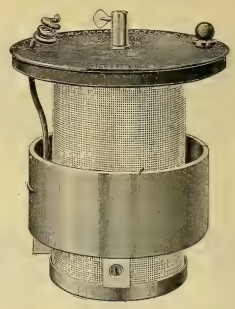

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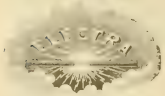

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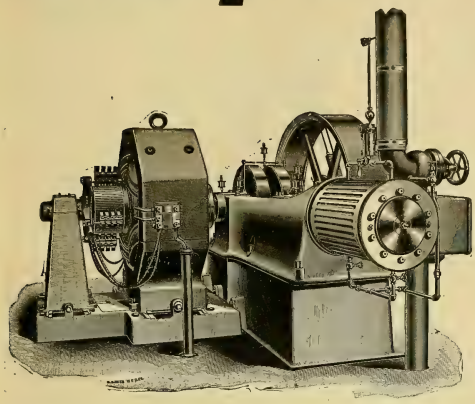

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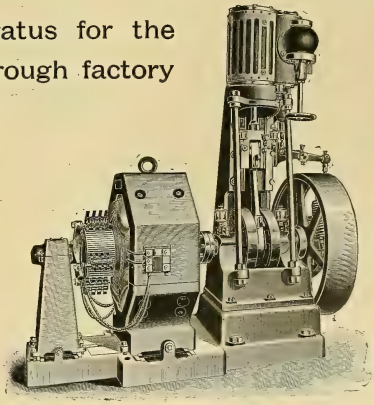
We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.



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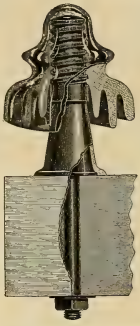

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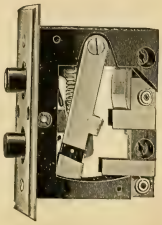

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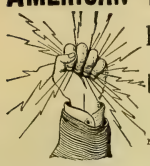

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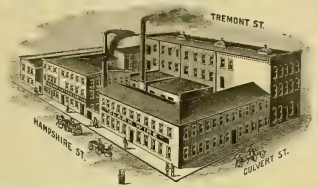


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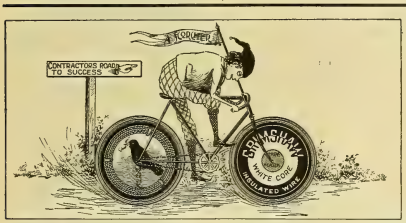


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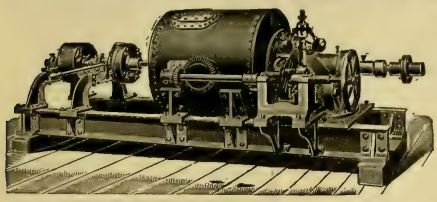

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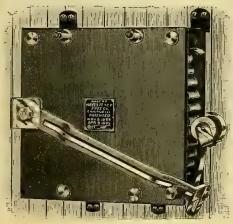

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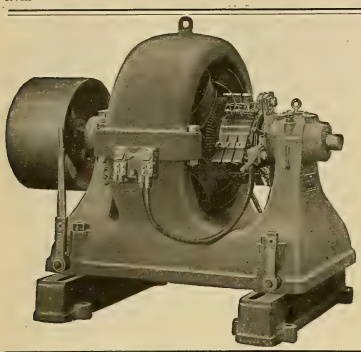

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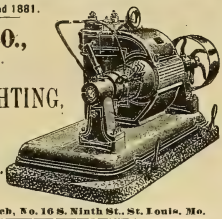

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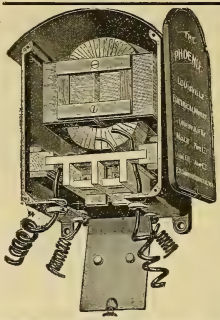

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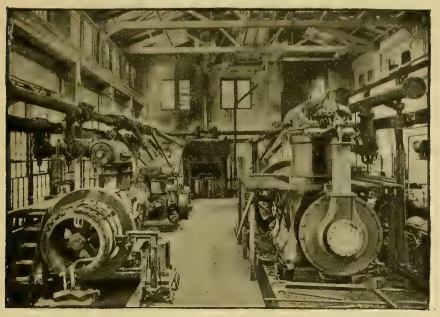

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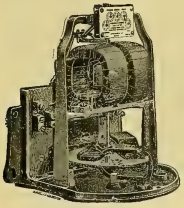

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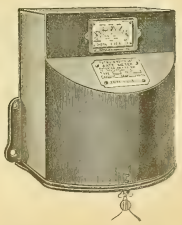

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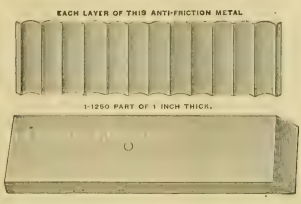


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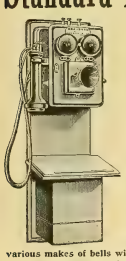

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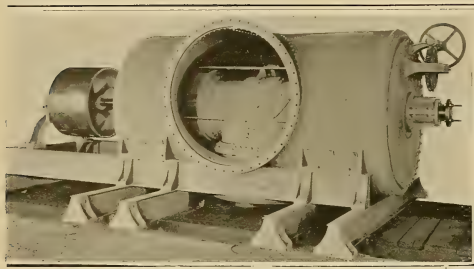

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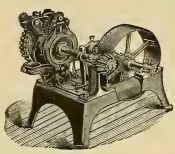

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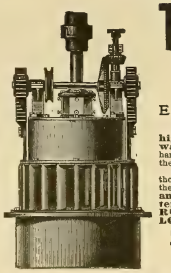

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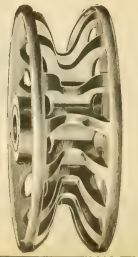

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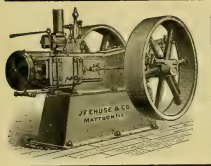


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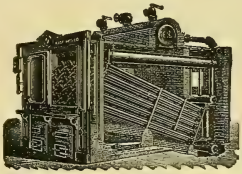

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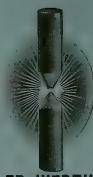

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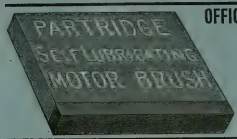


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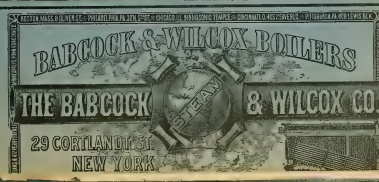

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Louisville Elec. Wks.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Nuttall Co., R. D.
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Gates Elec. Mfg. Co.
General Electric Co.
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Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel & Const. Supply Co.
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MacCurdy & Smith.
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New York Insulated Wire Co.
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Partrick & Carter Co.
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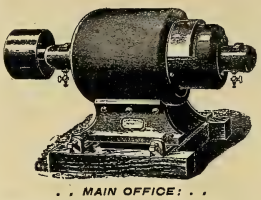

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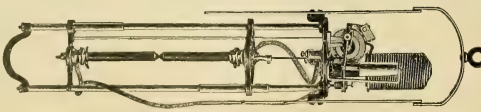

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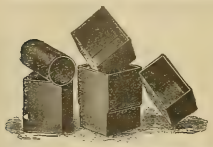

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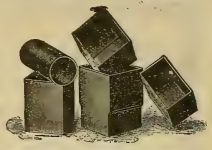

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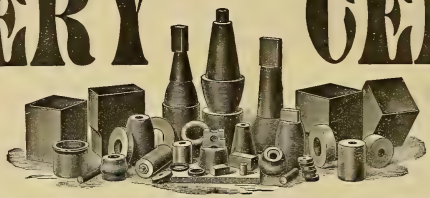

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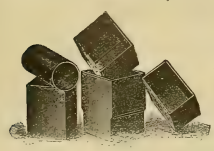

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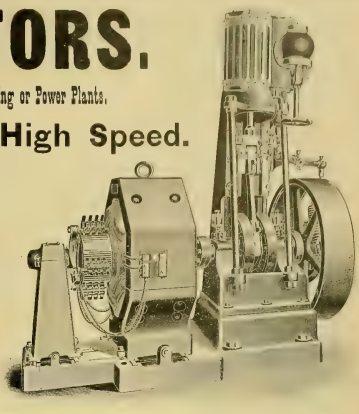

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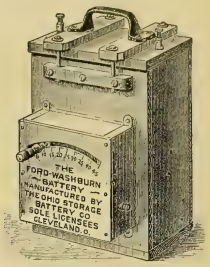
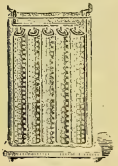



MEDICAL CELL.

The Ford-Washburn Storelectro Co.'s Car "Ideal," Equipped with its Cells, ascending a 6 per cent grade on the Cleveland & Berea Street Railway, with Loaded Trailer.



5 G CELL.

6 G CELL.

**The only Storage Battery that ever successfully operated a Railroad in winter as well as in summer. These Cells are soon to be used in another Railroad enterprise that will attract the attention of the whole country, they having been selected after a thorough examination of all other makes. Watch the press!**

**Many of our cells have been in hard use for four years without deterioration.**

The Cleveland *Leader*, of Oct. 25, 1895, had the following:

"The instantaneous death of Franklin Leonard Pope, the eminent electrical expert and publicist, at his home in Great Barrington, Mass., on the 13th inst., is the sensation of the hour in scientific circles. Mr. Pope descended to his cellar to examine a powerful converter, and by some means unknown received a shock which killed him on the spot. It is a fact of local interest that among the last important acts of Mr. Pope's life was the preparation of an elaborate opinion that the patents covering the Ford-Washburn Storelectro Company's storage battery DO NOT INFRINGE IN THE SLIGHTEST DEGREE ANY OTHER STORAGE BATTERY PATENTS. Mr. Pope's paper was dated the 5th inst., and was accompanied by an autograph personal letter."

Other opinions, equally strong, from H. T. Fisher, late U. S. Examiner in the Patent Office, E. A. Angell and others. WE WILL PROTECT ALL OUR CUSTOMERS FROM LITIGATION.

Department of Physics and Electrical Engineering:
UNIVERSITY OF ILLINOIS.

Champaign Ill Aug 19 1895

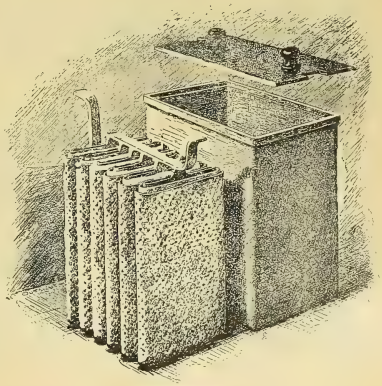
The Ohio Storage Battery Co
52 Wade Building.
Cleveland, Ohio

Gentlemen -

Please furnish the Department of Physics and Electrical Engineering with 100 Ford-Washburn storage cells in glass, type 6 G of 150 ampere hours capacity each, the time of shipment to be such that we may receive the cells by the middle of September My experience with them thus far, and the favorable comparison of these cells with the other types which we have already in use, show them to be the most satisfactory thing for general purposes that there is now on the market I sincerely hope you may meet with the success in your business that you deserve, if the cells which you are now manufacturing are as good a quality as the five which I have had in constant and hard use during the last three years

Yours truly
Daniel W. Shea
Professor of Physics & Elec Eng

Cell for operating Fans, Sewing Machines, Dentists' Lathes, Drills, etc.



TRACTION CELL.

## The Ohio Storage Battery Co.,

52 Wade Building, Cleveland Ohio, U. S. A.
New York and New England Office, J. A. MACHADO, 203 Broadway, New York.

# IT BEATS THE WORLD

*We have recently closed a contract with the Taunton Copper Manufacturing Company, as General Western Sales Agents for their complete line of*

# BARE COPPER WIRE

Including this with our other specialties, among which are

"OK" Weatherproof Wire
Paranite Wire
Packard Transformers and
Packard Lamps.

*We are now in position to assist you in making 1896 a profitable year.*

**ELECTRIC APPLIANCE COMPANY,** 242 Madison St., CHICAGO.
*ELECTRICAL SUPPLIES.*

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A NEW CIRCULAR describing the Hoyt Station Ammeters and Voltmeters sent free on application.

**WHITNEY ELECTRICAL INSTRUMENT CO.**
Penacook, N. H., U. S. A.

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ESTABLISHED 1857.

**WALLACE BARNES,**
*Manufacturer of*
FLAT, COILED AND WIRE
**STEEL SPRINGS**
OF EVERY DESCRIPTION.
Send sample for prices. Bristol, Conn.

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**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.

**SAMSON CORDAGE WORKS, - BOSTON, MASS.**

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LAMP GUARDS, GLOBE NETS, VENTILATING FAN GUARDS, WIRE GOODS OF ALL KINDS AT LOWEST PRICES.

Write for Circular and Prices.

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Endorsed by Board of Fire Underwriters.
SUPERIOR TO COTTON WASTE.
Safe, Durable and Cheaper.

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AMERICAN SILK MFG. CO.,
309 Walnut St., Philadelphia, Pa.

Agents wanted. Beware of loose woven imitations.

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T. H. Brady, New Britain, Conn., U. S. A.,
Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work. *Catalogues and Prices furnished on application.*

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And other Engineering Courses.

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**GASKETS MADE INSTANTLY WITH**

⅜ in. for **UNIONS.**
½ in. for **HAND-HOLES.**
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Put up in boxes, weight 3 to 6 lbs.

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# *The Bowen Electric Heaters*

**EXCEL THEM ALL!**

For HEATING TROLLEY CARS, Cabins, Staterooms, Show Windows, Portable Stoves, Etc. (Patented.)

*REQUIRE THE LEAST POWER.*

Reliable, Durable, Simple, Convenient. Best of all—**Warms the Car** evenly throughout. Adapted to all styles of cars, and every system of circuits. Rigids for sale. Correspondence solicited.

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Agents wanted in leading cities. Samples sent on approval to responsible parties.
**YOUNGLOVE & GERE,** Syracuse, N. Y.

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WE MAKE EVERYTHING IN THE LINE OF

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AND OUR PRICES ARE LOW.

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**Good Goods.**

**PROMPT SHIPMENTS.**

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Two Wires in a Single Tube, the Standard Method of Electric Wiring.

INTERIOR CONDUIT & INSULATION CO.,
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Edwd. H. Johnson, Prest. E. W. Little, Vice-Prest. and Gen. Mgr. Chas. P. Geddes, Sec'y and Treas.

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Montague Street Railway Co.
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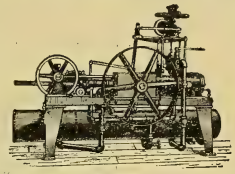
GENTLEMEN:—We have one of your Governors in use at our power house at Millers Falls, Mass., taking care of two water-wheels to perfection, regulating the power *within a few volts*. We took out one Governor and replaced it with a LOMBARD GOVERNOR which gives *perfect satisfaction*. Yours truly, MONTAGUE ST. RY. CO.,
(Signed) H. C. GARFIELD, Supt.



Sold on trial and absolutely guaranteed to hold wheel speed to satisfaction of purchaser, irrespective of sudden changes of load.
Send us a description of your water-wheel plant.

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We also manufacture Oak Pins and Brackets, and GENUINE BLACK LOCUST PINS.
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We guarantee our product equal to any in the market.
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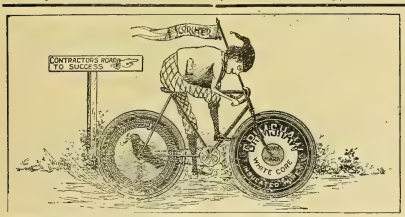
30 to 34 Market St., Chicago, Ill.
High Efficiency, Perfect Regulation, Best Material, Low Prices, Complete Plants Installed.

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The advertiser controls valuable electric heating patent (soldering irons, soldering outfits, etc.), and wants a young man, electrically educated and with some capital, to join him in pushing the electrical heating business already organized and established and with good orders on hand. A salary would be paid and young man and advertiser (business man) can control this business. Address "Heater," care WESTERN ELECTRICIAN.

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Traveling salesman to handle the best line of telephones on the market, on commission; also responsible party or parties who can secure contracts and install exchanges.

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As Superintendent or Engineer of electric light or power plant. Thoroughly familiar with high speed and slow engines, direct and alternating currents, inside and outside wiring, testing, etc. Fully capable of doing any repairs connected with a plant. A No. 1 machinist, at present am with a large plant but for good reason desire to change. Best of references from present and past employers. Will work for liberal salary. Address "Electrical Engineer," care WESTERN ELECTRICIAN, 6 Lakeside Building, Chicago.

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CHEAP FOR CASH.

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One 45 light 2,000 c. p. T.-H. Arc Dynamo, complete with base, frame, slides and automatic regulator. One 35 k.w. 1,040 volt T.-H. Alternator, complete with exciter and switchboard instruments. One 15 h. p. 220 volt Eddy Motor, with extra armature (new.)

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For the purpose of closing an estate, I hereby offer for sale the controlling interest in the Dundee Electric Light Co. This company is doing a safe and profitable business. A majority or all of its stock can be bought at a reasonable figure. Original cost $40,000. Plant only 3 years old. See or write J. R. SMITH, Assignee, Dundee, Ill.

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BRASS PATTERNS AND CASTINGS, all kinds.
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Are made only by
Charles Wirt, 1026 Filbert, Philadelphia.
For Sale by the Trade.

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**$600! $600!**

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New 50 Light Arc Dynamo,

Complete with the usual accessories and full guaranty of manufacturers. Have no use for it and will be sold for 25 hundred dollars cash.

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THE WESTERN UNION TELEPHONE COMPANY,
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Telegraph, Telephone, Electric Light
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FROM THE STUMP TO THE CONSUMER.
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BY
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Concise and Practical Explanations for Plumbers, Tinners and Hardware Dealers on How to Wire Buildings for Bells, Alarms, Annunciators, and for Gas Lighting from Batteries.

*Illustrated with Twenty-two Diagrams.*

By WILLIAM A. WITTBECKER.

Price in Paper, 25 Cents.
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THE growing demand for simple electrical apparatus in dwelling houses, offices and workshops and the need of plain instructions whereby any person without a previous knowledge of electricity may be enabled to undertake their successful installation, has prompted the publication of this little book. It is not intended for the amateur who seeks for nothing but experimental work, neither is it expected to enlighten the expert electrician; but to the person who is seeking for information that will assist him in increasing his daily earnings the little volume is addressed.

The information given is above all else practical, and with a close observance of the directions laid down anyone without the slightest knowledge of electricity should be able to do the work described

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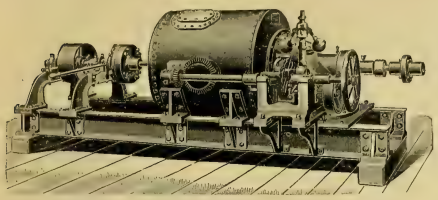

**Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.**

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

*SEND FOR CATALOGUE AND PARTICULARS.*

The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts, and where the situation admits of their use we recommend them.

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Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agents.

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*The Standard Open Circuit Batteries of the World.*

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Some specialties are:

**WIRT AMMETERS, WIRT VOLTMETERS,** } Accurate, Low Priced.

**PHOTOMETERS,**

**D'ARSONVAL GALVANOMETERS,** } Sensitive, and Dead Beat.

Correspondence Solicited.

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About the very best motor and dynamo made it is a ten to one shot that he will mention the name "Kester," because every purchaser becomes a friend and, like quality, talks. Our motors are doing duty in thirty-seven states of the Union, and in point of electrical efficiency and mechanical durability they are without an equal. They are sold on their merits and guaranteed to be absolutely perfect. Our dynamos are superior to any machine of like rated capacity now on the market. Each size has

**SLIDING BASE, SELF-OILING AND SELF-ALIGNING BEARINGS**

and will carry the rated capacity without any Sparking or Heating, are Noiseless and guaranteed free from any defect. Further particulars cheerfully furnished

## KESTER ELECTRIC CO., TERRE HAUTE, INDIANA.

**RICHARDS & MEACHAM, Sole Chicago Agents, 86 LA SALLE STREET, CHICAGO.**

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**PRIMARY BATTERIES.**

**OVER 5 VOLTS-5 AMPERES FROM 1 CELL**

BOYNTON MULTIVOLT BATTERY CO., 169 Greenwich St., Cor. Cortlandt. NEW YORK.

ONE SOLUTION. Size, 6x8 in.

**Price, $6.50.**

Send for Sample.

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In the Book Line

ORDER A COPY OF

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**CARD** Generators for Power Transmission or Isolated Lighting.
CARD Generators are all Multipolar and Slow Speed.

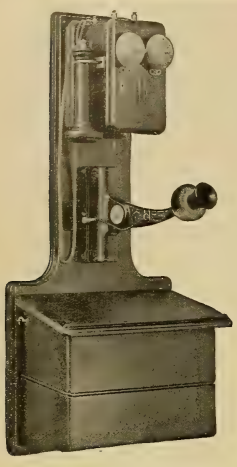
AGENTS WANTED IN UNOCCUPIED TERRITORY.

75 K. W. GENERATOR.

**CARD** Multipolar Slow Speed Stationary Motors.
Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

**THE CARD ELECTRIC COMPANY,**

Office and Works, Mansfield, Ohio.



# SOLD ON THEIR MERITS.

In placing this instrument on the market we take pleasure in stating that after a series of tests made by one of the largest railroad corporations in the United States, and by several of the best informed Telephone Experts in the country, we have been informed that our instruments far surpass any telephone now on the market, for the following reasons:

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**Impossibility of Packing under any Conditions;**

**Sensitiveness and Clearness of Articulation;**

**Least Affected by Induction of any Instrument now on the Market;**

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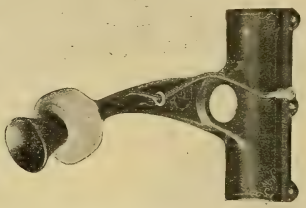

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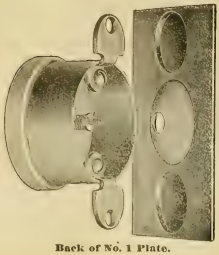

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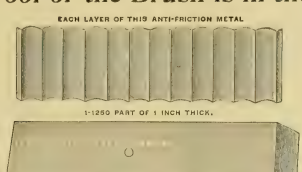


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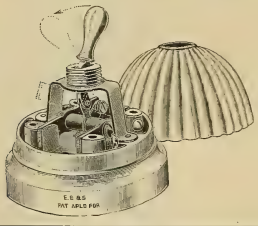

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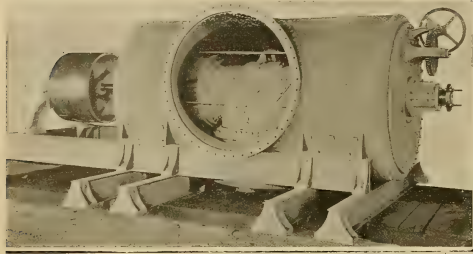

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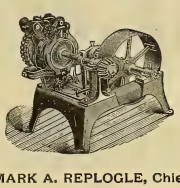

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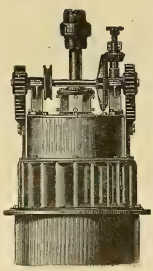

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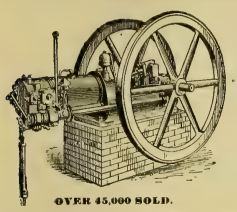

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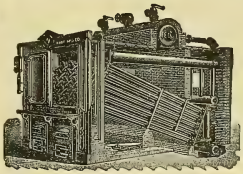

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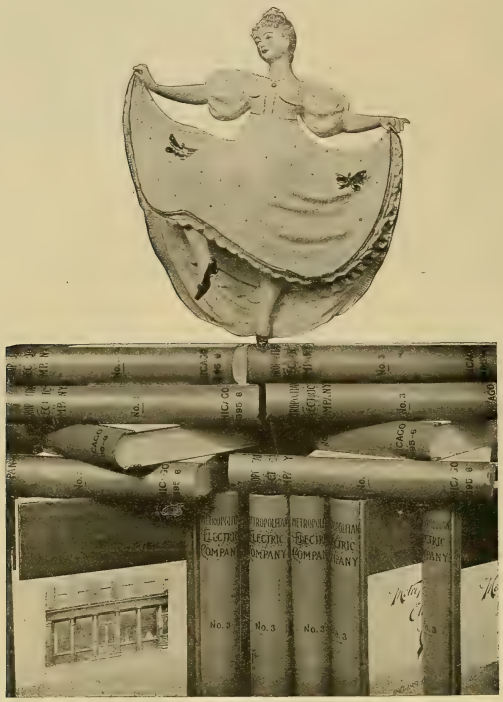


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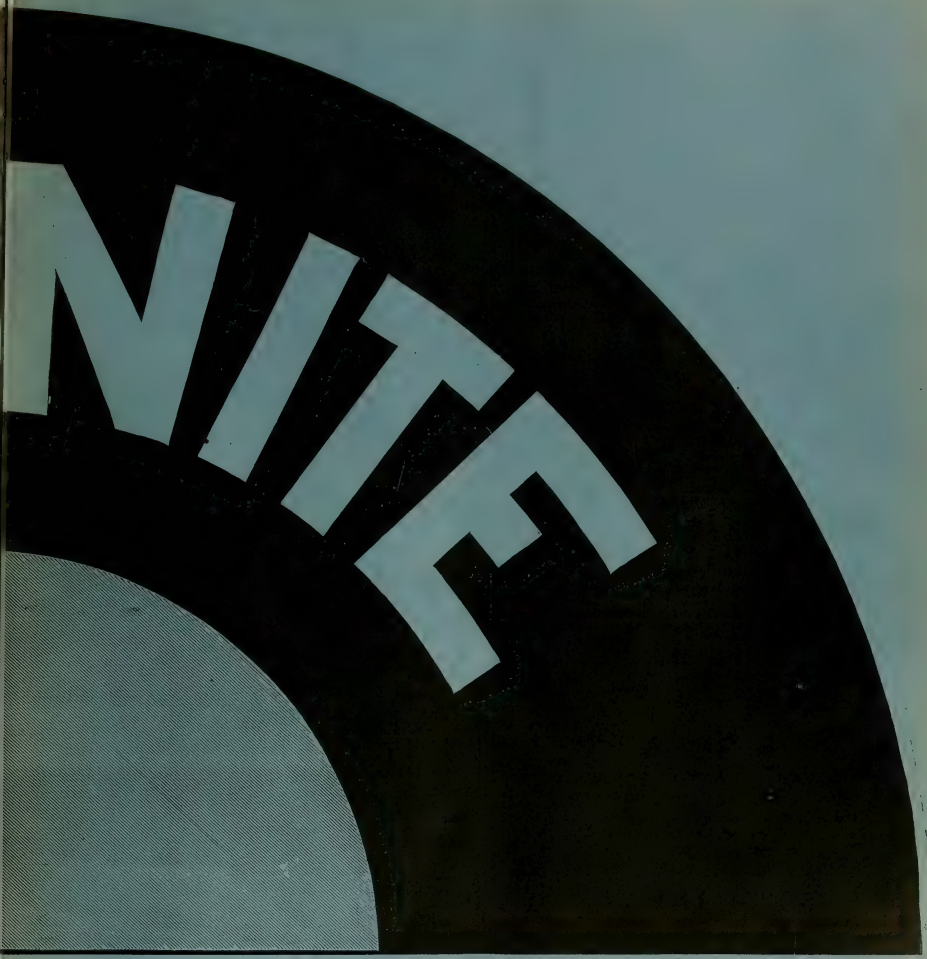


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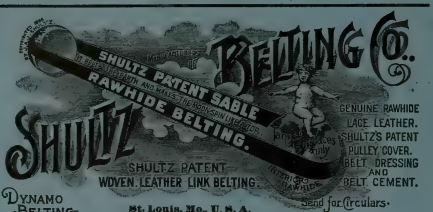


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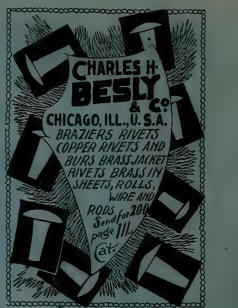


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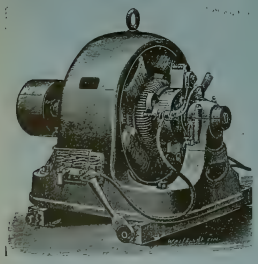

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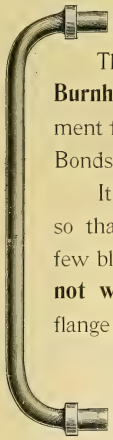

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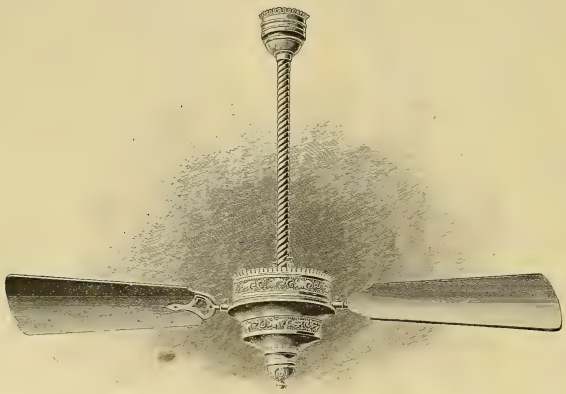

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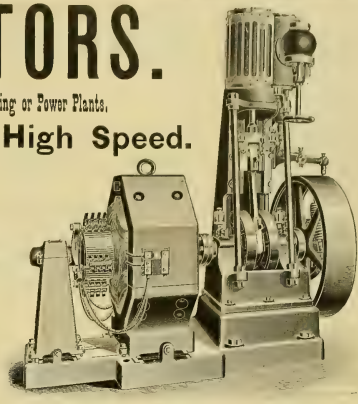

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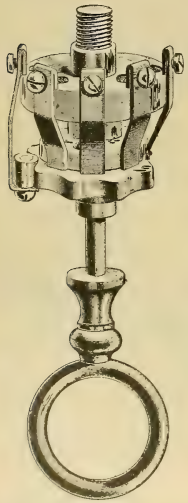

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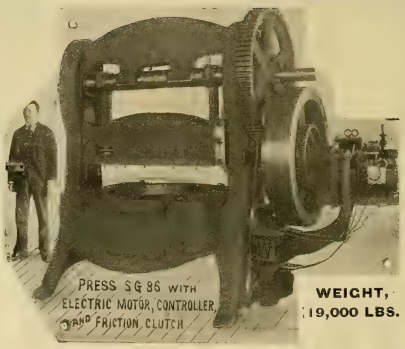


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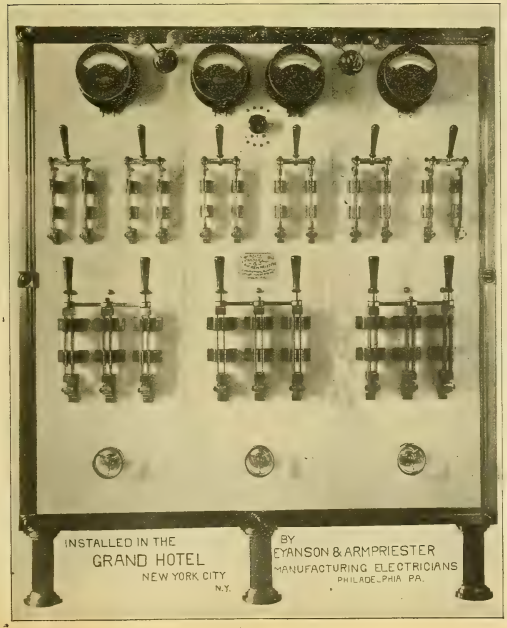


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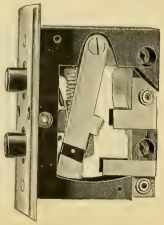

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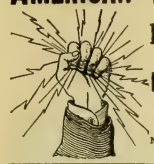

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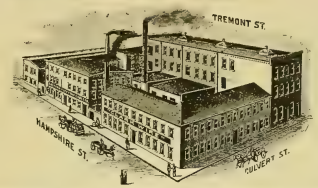


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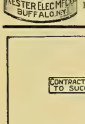


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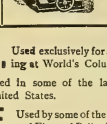

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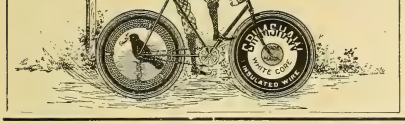


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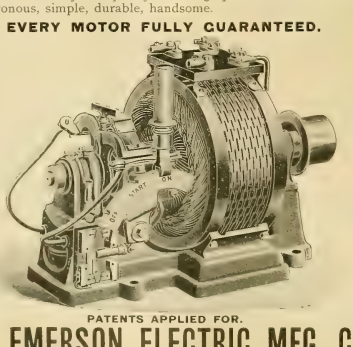

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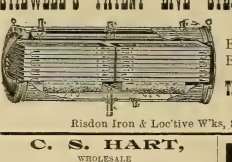

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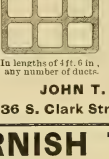

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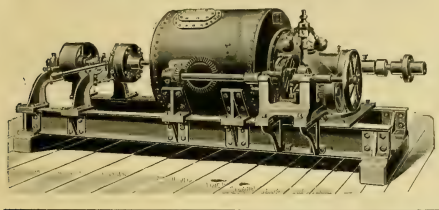

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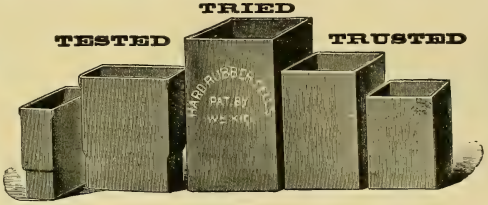


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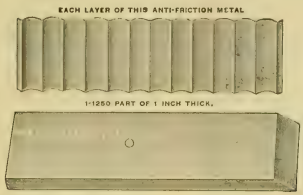


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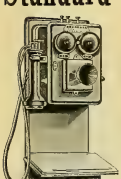

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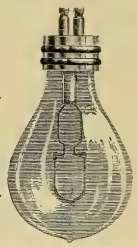

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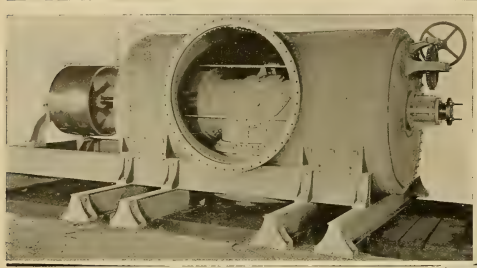

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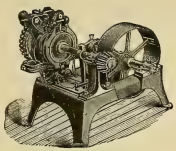

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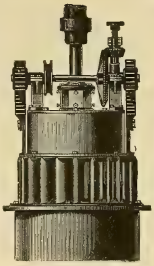

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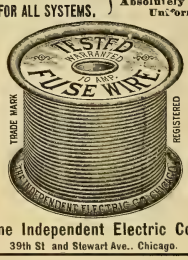


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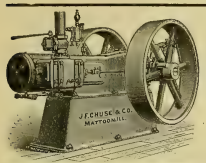


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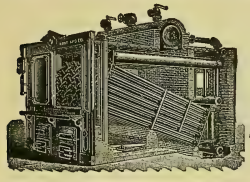

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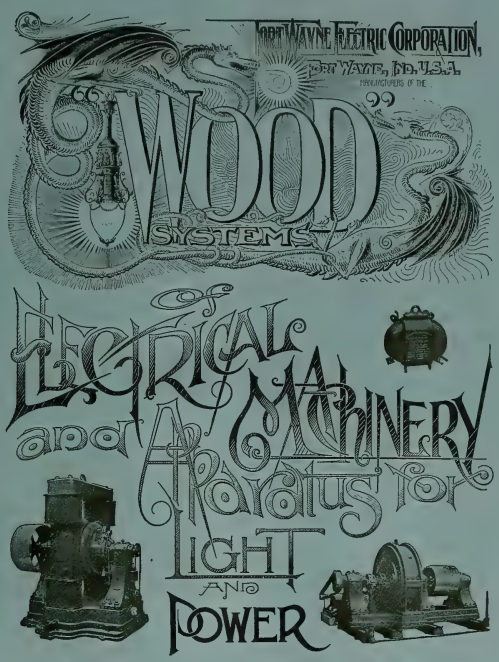


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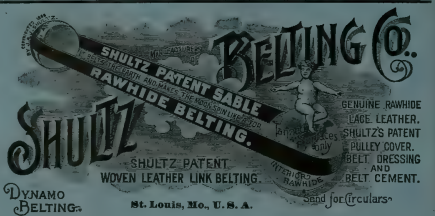


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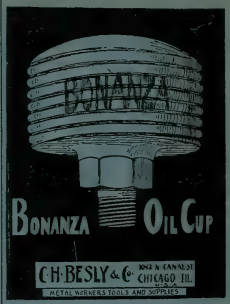

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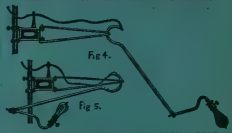

Fig 4.



Fig 5.

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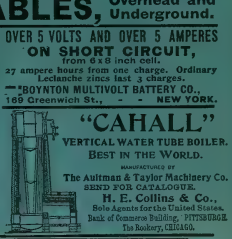

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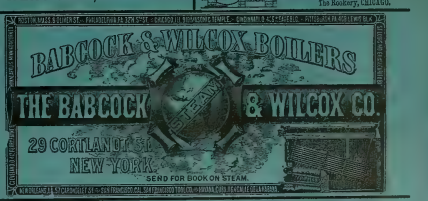


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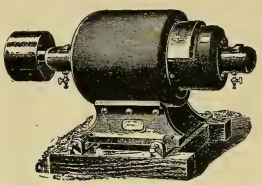

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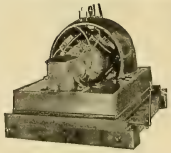

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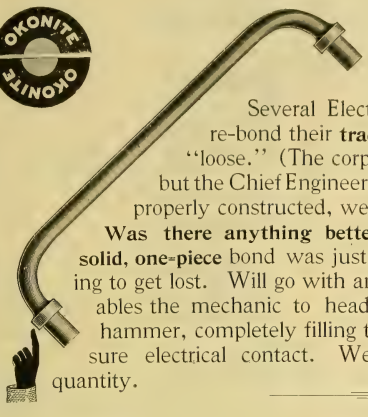

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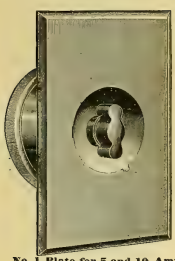

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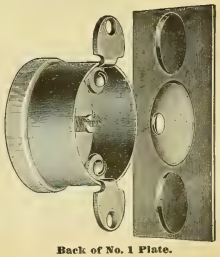

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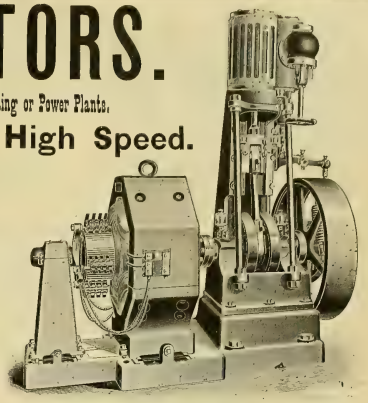

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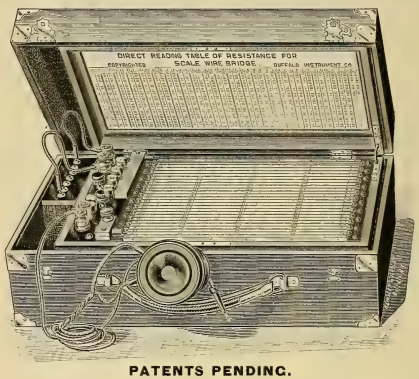


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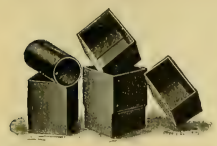

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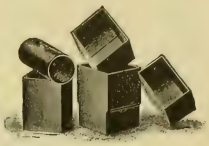

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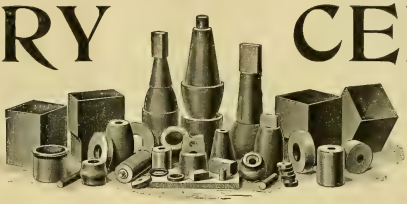

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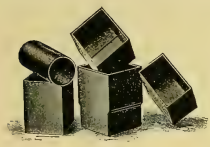

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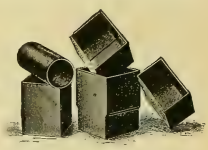

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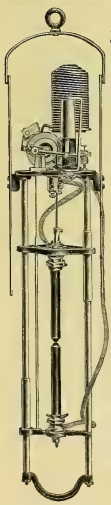

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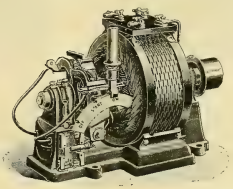

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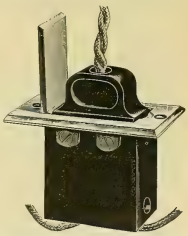

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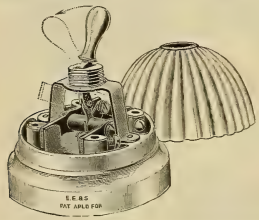


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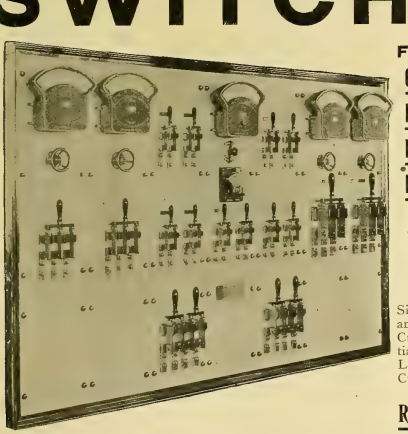

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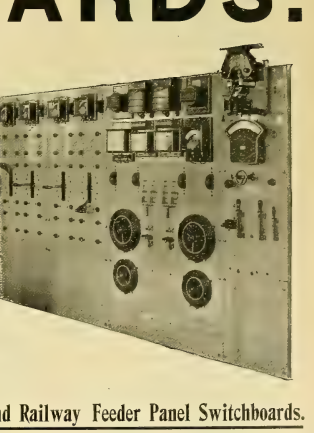

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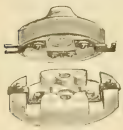

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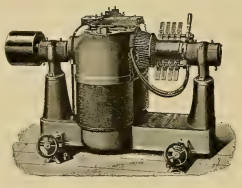
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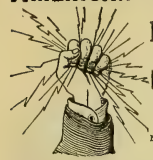

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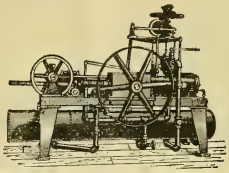

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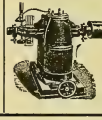

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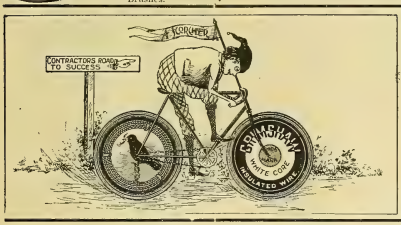


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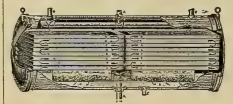

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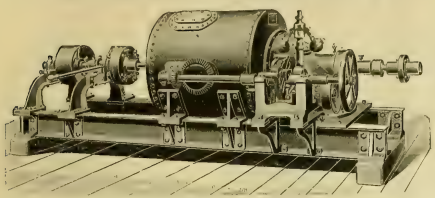

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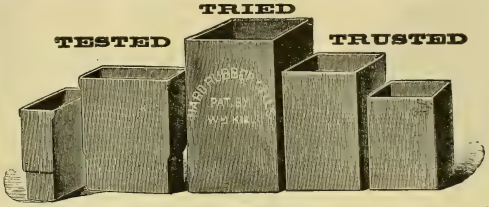


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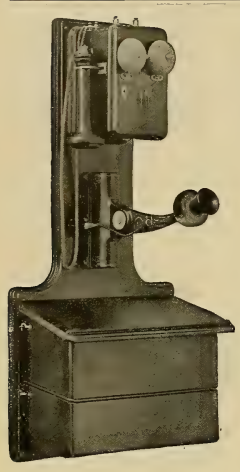

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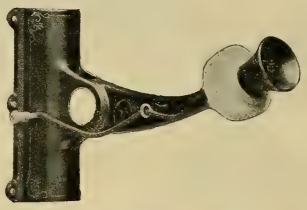

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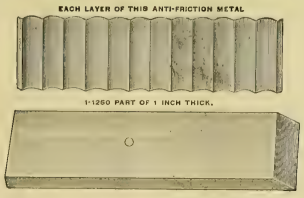


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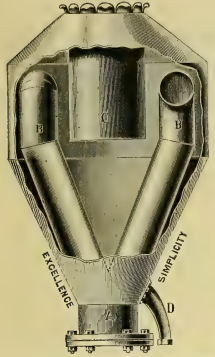


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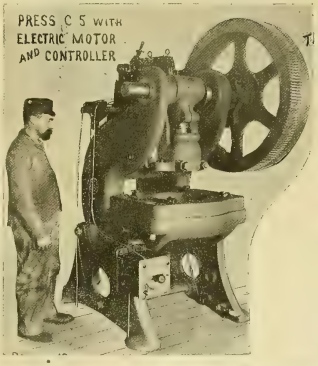


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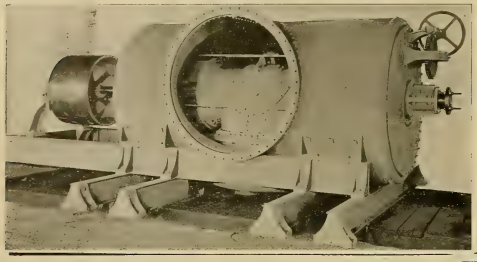

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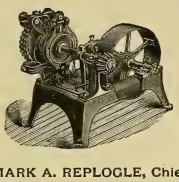

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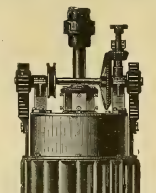

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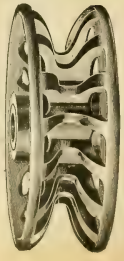

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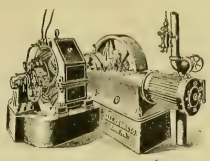

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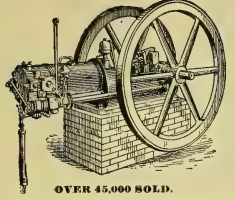

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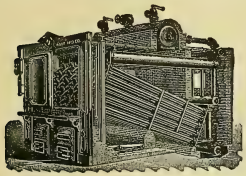

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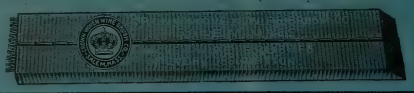

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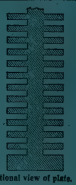

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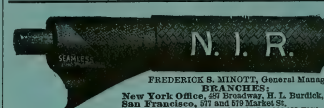


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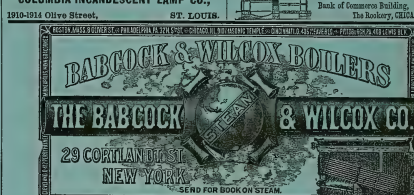


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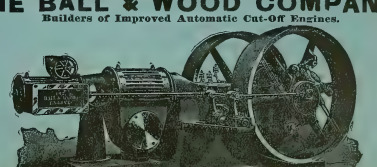

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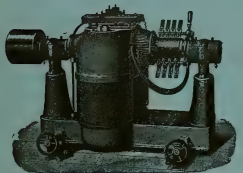

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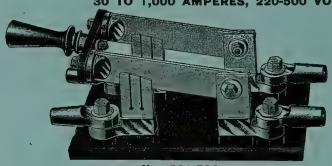

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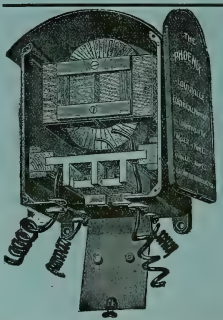

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Chicago Belting Co.
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Rhoads & Sons, J. E.
Shultz Belting Co.

**Boilers.**
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Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
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Moyes, L. M.
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Phosphor Bronze Sm.Co.,Ltd.

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Brixey, W. R.
Central Electric Co.
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Moore, Alfred F.
New York Ins. Wire Co.
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Central Electric Co.
Chicago Gen'l Fixture Co.
General Electric Co.
Mason, J. W.
Partridge Carbon Co.
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Besly & Co., Chas. H.
Brixey, W. R.
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Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
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Okonite Co. The.
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Brady, T. H.
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Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
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Eddy Elec. Mfg. Co.
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Interior Conduit & Ins. Co.
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MacCurdy & Smith.
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Bernardin, F. M.
Brixey, W. R.
Butler Hard Rubber Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
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Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
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New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
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Southern El. Con. & Sup. Co.
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**Insulated Wires and Cables—Magnet Wire.**
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Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
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Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.

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Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
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Storey Motor & Tool Co.
Walker Mfg. Co.
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Garlock Packing Co.
Peerless Rubber Mfg. Co.

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MacCurdy & Smith.

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Hart, C. S.
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Besly & Co., Chas. H.
Brixey, W. R.
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House and Hotel Style.

Gravity Drop, Three Wire System.

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BINDING... POSTS of ...EVERY DESCRIPTION.

## MEDICAL FARRADIC BATTERIES, INDUCTION AND SPARK COILS.

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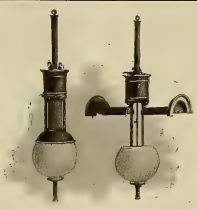

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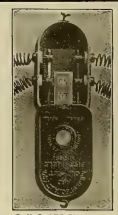

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S. K. C. Switches. S. K. C. Hanger Boards. Dynamo Brushes, Commutator Compound, Etc.

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Long Life, Efficiency,
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It is Absolutely Non Freezing,
Labor Saving,
Free from Local Action,
Freedom from Gases and Odors.
Superior Generation of Energy.

These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America.
Send for descriptive circular and price list. We guarantee all our Cells.

MANUFACTURED BY

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Strong and Light,
Highest Grade Workmanship and Material.

**Moulded Mica Insulation.** **Vulcabeston** Controller Parts, etc.

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## INCANDESCENT LAMPS

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

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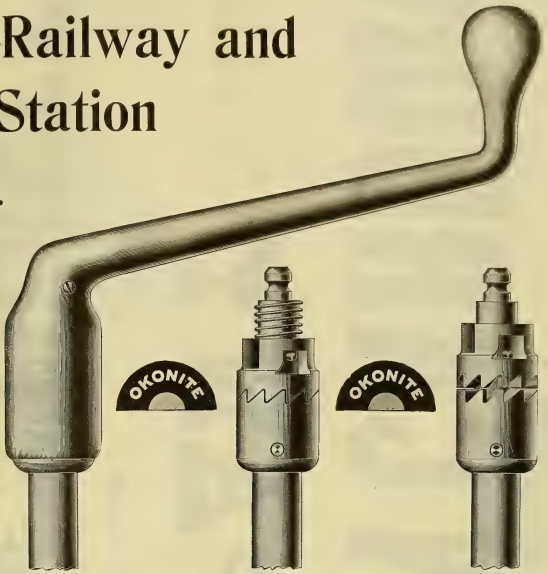
## "A" ARC AND INCANDESCENT LAMPS and IRON HANGER BOARDS "B"

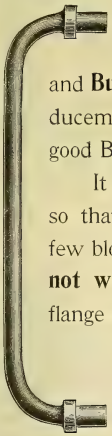
## THE ADAMS & BAGNALL ELECTRIC CO. CLEVELAND

# Electric Railway and Central Station Supplies.




This cut illustrates the Kelsey **Noiseless** Ratchet Brake.

Backward turn is made **without** friction on the teeth and consequently there is no **wear** and **tear.** We carry these in stock.



There must be a great measure of **real merit** in the **Benedict** and **Burnham** solid one-piece **Rail Bonds,** else there would be no inducement for a Railway Company to pull out hundreds of other fairly good Bonds to replace with them.

It is the only solid Bond with a ***shoulder*** and can be headed up so that it fills the hole perfectly. A button head is formed with a few blows, drawing the shoulder up tight against the rail. **They will not work loose if properly set.** Bond lies close up under the rail flange and is thereby well protected.

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*(Write to the Works at Noblesville, Ind., for Prices on anything in Carbon.)*

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**Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.**

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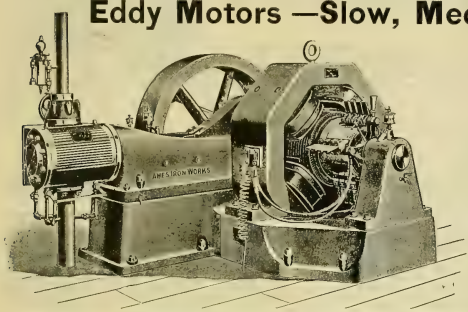

**We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.**

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Single Pole, Double Pole, 3-Way, 4-Way, anything you may want.

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These Switches are second to none. They are fire and damp proof. Mechanism is simplicity itself. Nothing to get out of order. Make and break so wide that no arc can form. Wired without removing casing. Buttons made of mother of pearl. Base made of vulcabeston with porcelain cases.

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**Write for price list and discount.**

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**MANUFACTURERS,**

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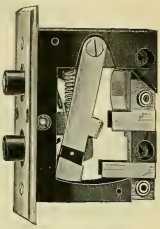
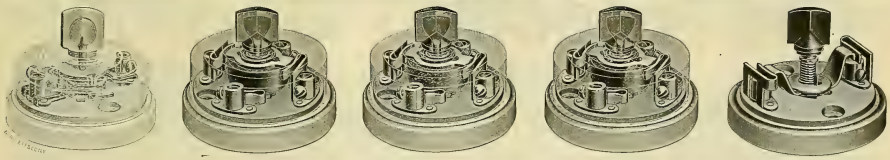


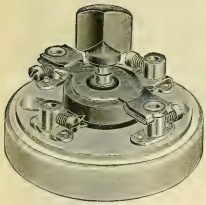
New Double Pole.



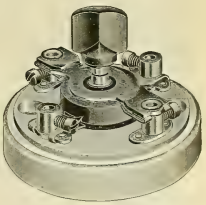
## ...CAUTION...

All Hart Switches have always had

## "Hart Switch"



stamped on the metal parts of the Switch and **WE CAUTION** all users to examine their goods carefully and see that they get the genuine article....



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....MANUFACTURERS OF....

## "GLOBE" INCANDESCENT LAMPS.

**ABSOLUTELY DRY VACUUM.**

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# NATIONAL ELECTRICAL EXPOSITION,

## NEW YORK, MAY 4 TO JUNE 1, 1896.

**Held under the auspices of and in connection with the Nineteenth Convention of the**

## National Electric Light Association,

**Industrial Building, Lexington Avenue, Forty-third to Forty-fourth Streets.**

**Manufacturers of Electric Light and Street Railway Apparatus, and Electrical Supplies and Appliances, who desire to be represented, should apply for space at once. Steam will be furnished to exhibitors in any quantity; Electric Current, direct or alternating, at any voltage. Applications for space or further information should be addressed**

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# The "Electra" Carbons.

ELECTRA

•TRADE MARK•

**IMPORTED**

## HIGH GRADE NUERNBERG CARBONS

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**FOR DIRECT CURRENT ARC LAMPS. FOR ALTERNATING CURRENT ARC LAMPS.**

**Are by far the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light, burning without any dust.**

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Sole Importer for the United States and Canada.

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**PERKINS INCANDESCENT LAMPS,**

**....SOCKETS, ROSETTES, SWITCHES.**

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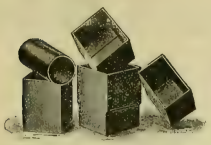

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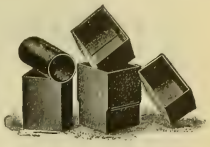

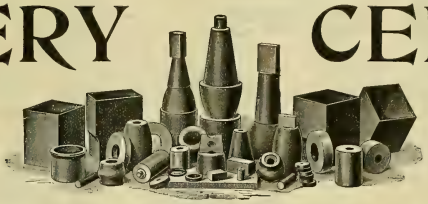

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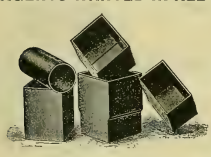
**STANDARD SIZES ALWAYS ON HAND.**

The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished, providing additional strength to such an extent that this cell can be used where no other would be practical.

## THESE CELLS ARE A NEW PRODUCTION AND FULLY GUARANTEED.

**AGENTS WANTED IN ALL CITIES.** **WRITE US FOR INFORMATION AND CATALOGUE.**



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J. Frank Dunbar, Treasurer, **NEWTON RUBBER CO.,**

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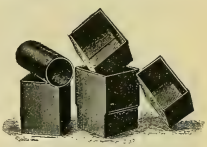
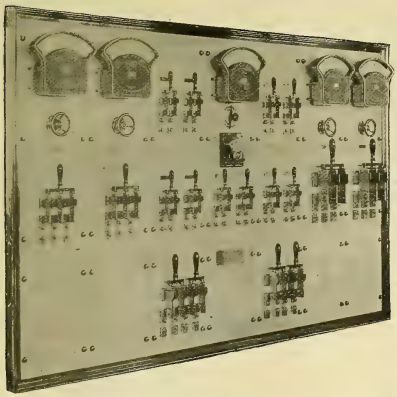


# SWITCHBOARDS.



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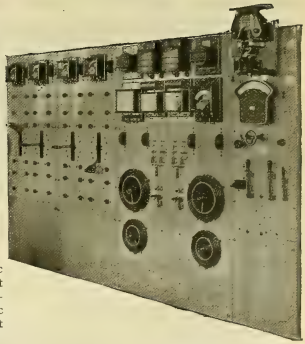
**Central Lighting, Railway and Power Stations and Isolated Plants.**

**For High and Low Tension Alternating Current Distribution.**

Single Phase, Monocyclic and Three Phase Direct Current Constant Potential, Incandescent and Arc Lighting, and Constant Current Arc Lighting,



**Railway Generator and Railway Feeder Panel Switchboards.**

## SWITCHBOARDS FOR MILL, FACTORY AND MINE WORK.

In the manufacture of Switchboards of all descriptions the General Electric Company possesses facilities unequaled in the world. These and its long experience enable it to furnish Switchboards in Panel Form or otherwise of finished design and workmanship, electrically and mechanically perfect, at comparatively low cost.

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**Sales Offices in all Large Cities in the United States. For Canada address Canadian General Electric Company, Toronto.**

While we appreciate the fact that

# LONG LIFE

is not the only thing to be considered in an incandescent lamp, at the same time there is considerable satisfaction in the following statement which accompanied a burned out Packard lamp returned to the factory recently as a souvenir:

**"This Lamp has been in Constant Use for Two Years and Two Months."**

This means a life of over

# 19,000 HOURS.

☞ The Packard lamp is just as "long" on candle-power and efficiency as it is on life.

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## Most Extensive Electrical Outfitters South of Philadelphia.

INCANDESCENT LAMPS, ARC LAMPS, ELECTROLIERS, STORAGE BATTERIES, TELEPHONES, PHONOGRAPHS, TELEGRAPH INSTRUMENTS, MEDICAL OUTFITS, ELECTRIC FANS, BATTERIES, BELLS, SPEAKING TUBES,

**Railway and Marine Supplies, Dynamos, Motors and Engines.**

Armature Winding, Repairing, and Maintenance of Electrical Machinery.

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SEND FOR SAMPLES AND PRICES OF

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For Arc Light and Trolley Cord.

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YOUNGLOVE & GERE, Syracuse, N. Y.

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Write for Circular and Prices.

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## CONDUITS.

In lengths of 4 ft. 6 in., any number of ducts.

Are you interested in Conduits?

If you are it will pay you to look into the merits of the latest — undoubtedly the best.

JOHN T. McROY,

36 S. Clark Street, Chicago.

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## Current Ammeters ....AND.... VOLTMETERS

FOR SWITCH-BOARD WORK

are superior to anything on the market, and our prices well, write to us and we will tell you all about them.

Whitney Electrical Instrument Co.,

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GASKETS MADE INSTANTLY WITH

3/4 in. for UNIONS.

1/2 in. for HAND-HOLES.

1/4 in. for MAN-HOLES.

Put up in boxes, weight 3 to 6 lbs.

Patented and Manufactured exclusively by

PEERLESS RUBBER MANUFACTURING CO.,

970 Old Colony Bldg., CHICAGO. 16 Warren Street, NEW YORK

# A PERFECT MANHOLE COVER.

**Not Expensive.**
**Horses cannot slip on it.**
**Streets can have an even surface.**

SEE WHAT IS IN OUR FAVOR

"A" "Creger" Cover Surface 4 ft. 6 in. x 5 ft.
Old Style Cover Surface 2 ft. 8 in. x 4 ft. 2 in.

CAN BE USED ON OLD MANHOLE FRAME.

LIBERAL ARRANGEMENTS for Parties to Manufacture in all Leading Cities.

WRITE FOR PARTICULARS.

The Creger Manhole Cover Co.,

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# ELECTRICAL FIXTURES,

A FULL LINE IN STOCK.

# Chicago General Fixture Co.,

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EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy.

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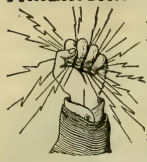

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

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THE

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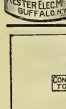


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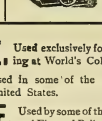

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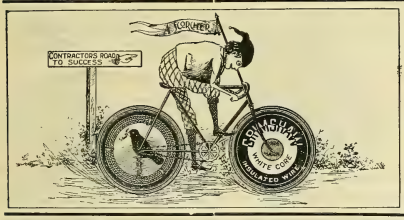


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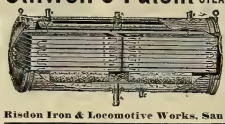

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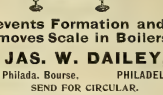

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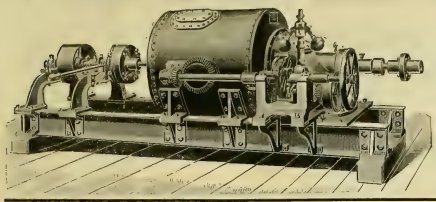

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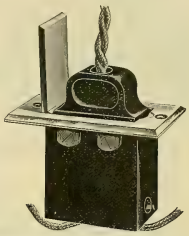

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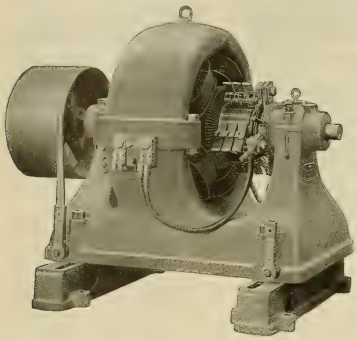

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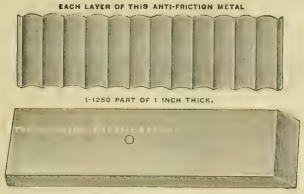

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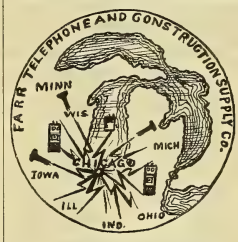


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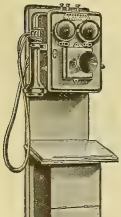

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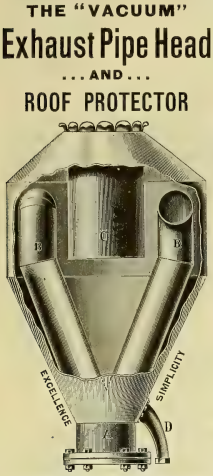


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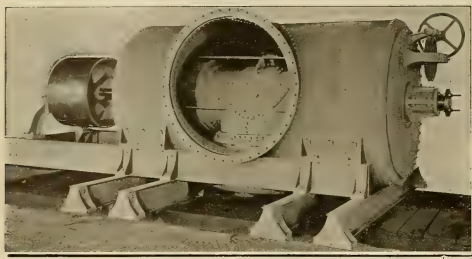

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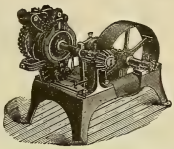

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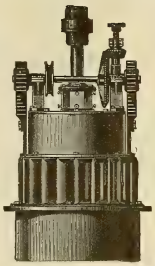

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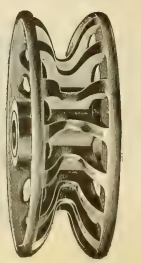

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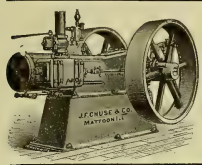

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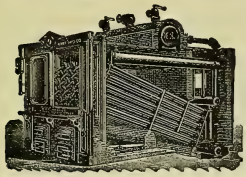

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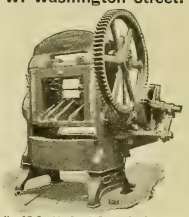

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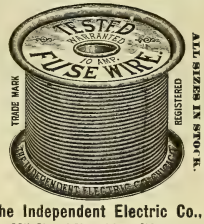


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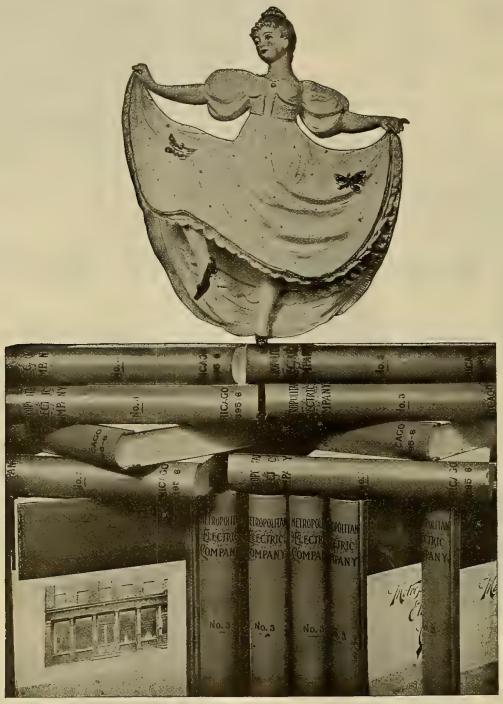


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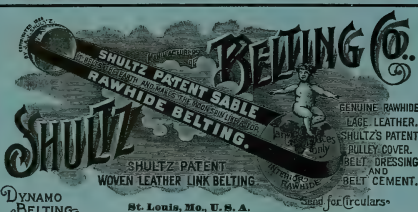


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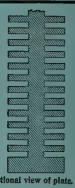

Sectional view of plate.

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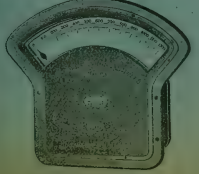

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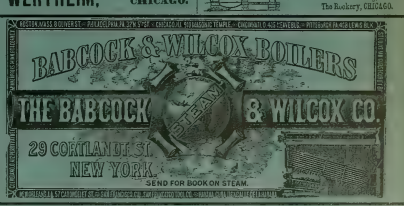


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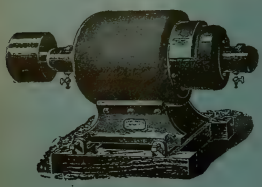

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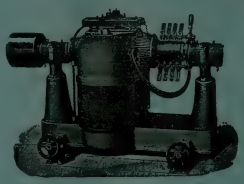

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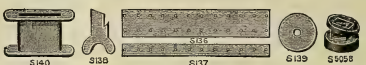


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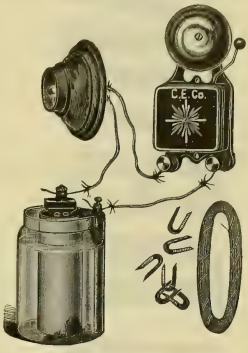


P. S.—This cut does not correctly illustrate the bell we are writing about. We will show a correct photograph a little later, **but the bell is all right.**

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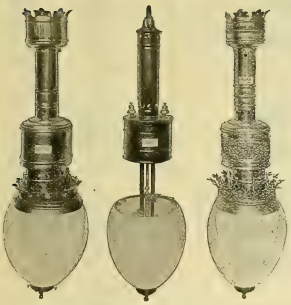

# AJAX

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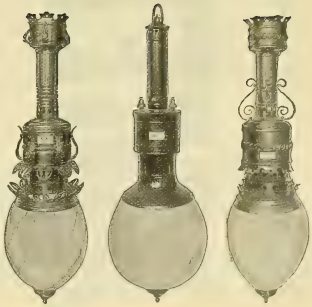

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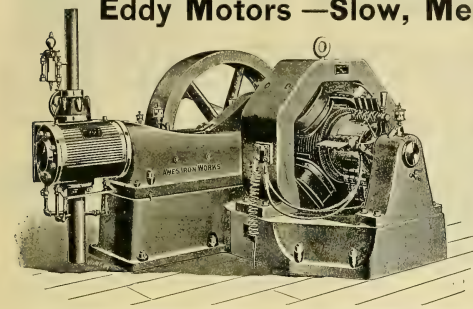

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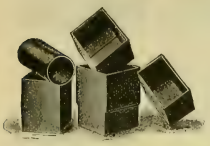

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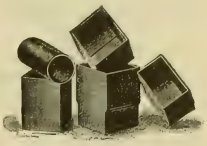

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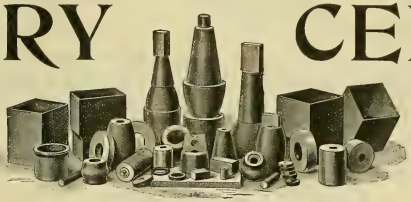

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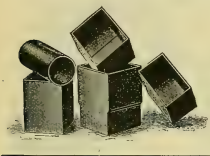

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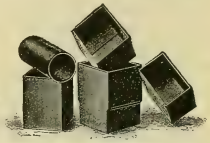

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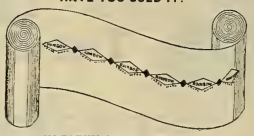

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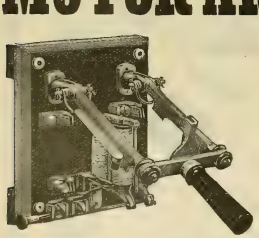

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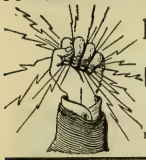

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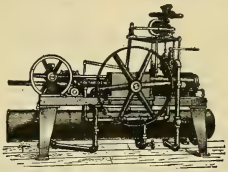

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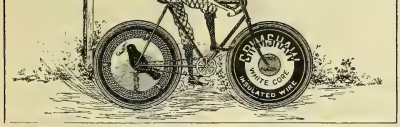


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Said contract to be for the term of five years, from and after May 3, 1896.

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The council reserves the right to reject any or all bids.

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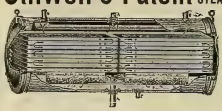

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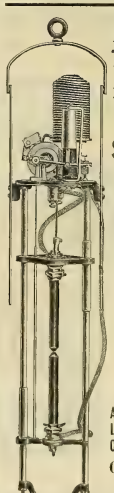

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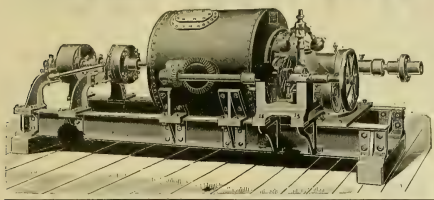

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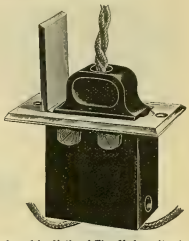

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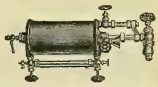

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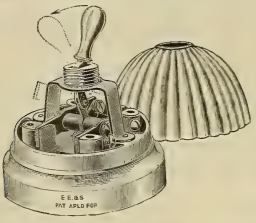


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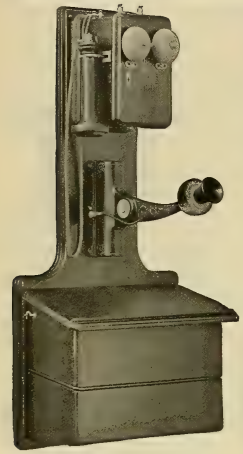

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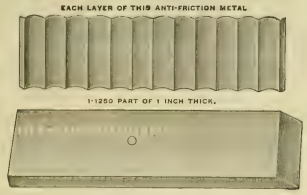

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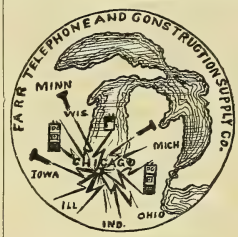


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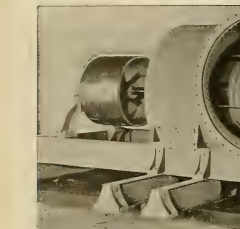

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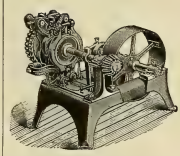

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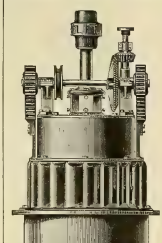

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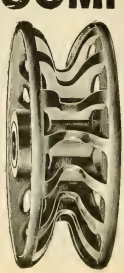

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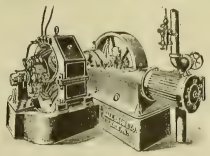

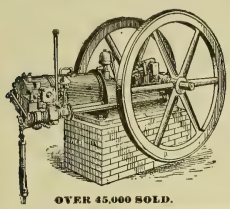

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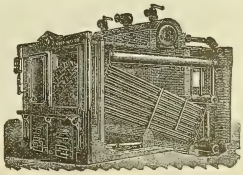

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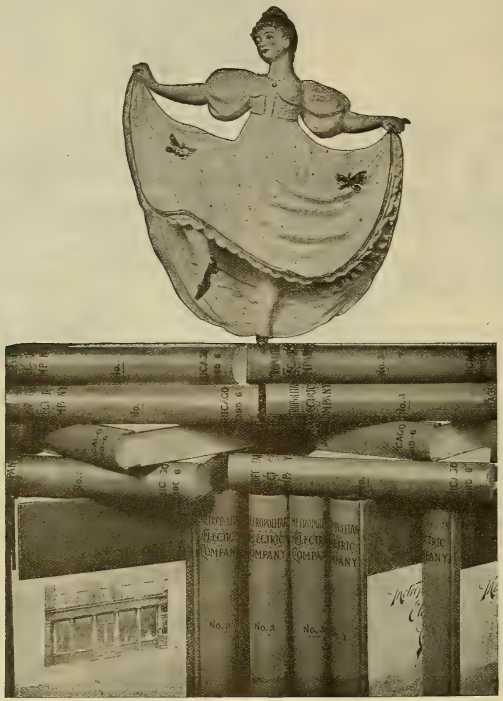

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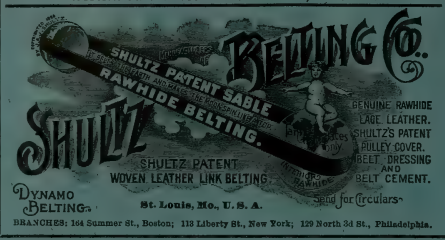


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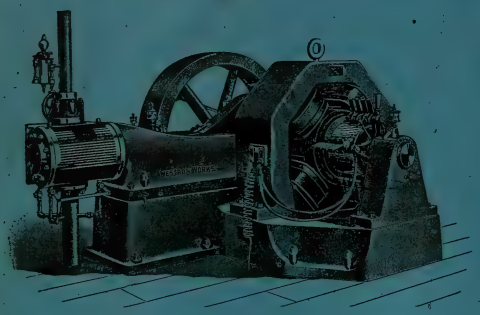

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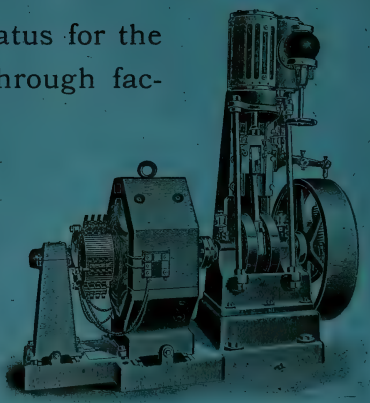

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## CLASSIFIED LIST.


**Accumulators.**
American Battery Co.
Electric Storage Battery Co.
Hess Storage Battery Co.
Ohio Storage Battery Co.

**Annunciators.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
Mason, J. W.
Menominee El. & Mech. Co.
Partrick & Carter Co.

**Arc Lamps.**
Adams-Bagnall Elec. Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Fleming-Spence Elec. Co.
Ft. Wayne Elec. Corporation.
Perkins Elec. Switch Mfg. Co.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Boynton Multivolt Batt'y Co.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Storage Battery Co.
Gordon-Burnham Bat. Co.
Leclanche Battery Co., The.
Mason, J. W.
Menominee El. & Mech. Co.
Newton Rubber Wks.
Northwest Engineering Co.
Ohio Storage Battery Co.
Partrick & Carter Co.
Western Electric Co.

**Bells.**
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
National Electric Co.
Partrick & Carter Co
Western Electric Co.

**Belting.**
Channon Co., H.
Chicago Belting Co.
Jewell Belting Co.
Rhoads & Sons, J. E.
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Collins & Co., H. E.
Moyes, L. M.
Murray Iron Works Co.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Bernardin, F. M.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Crown Woven Wire Brush Co.
Holmes Fibre-Graphite Co.
Mason, J. W.
Phila. Elec. & Mfg. Co.
Partridge Carbon Co.
S. K. C. Specialty Co.
Solar Carbon & Mfg. Co.
Wirt, Chas.
Younglove & Gere.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Menominee El & Mech. Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Carbons, Points & Plates.**
American Carbon Co.
Bernardin, F. M.
Central Electric Co.
Chicago Gen'l Fixture Co.
General Electric Co.
Mason, J. W.
Partridge Carbon Co.
Reisinger, Hugo.
Solar Carbon & Mfg. Co.
Wertheim, Ed.
Western Electric Co.

**Cigar Lighters.**
National Electric Co.

**Compound.**
S. K. C. Specialty Co.
Standard Paint Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.
McRoy, Jno. T.

**Construction & Repairs.**
Bernardin, F. M.
Ft. Wayne Elec. Corporation.
Richards & Meacham.

**Contractors and Electric Light Plants.**
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
Card Electric Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Schott, W. H.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas H.
Bowers Bros.

**Copper Wires.**
American Electrical Works.
Bernardin, F. M.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Menominee El. & Mech. Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Bernardin, F. M.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Mason, J. W.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bernardin, F. M.
Brodie Electric Co.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
Phila. Elec. & Mfg. Co.
S. K. C Specialty Co.

**Dynamos.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
Electrical Eng. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Siemens & Halske Elec. Co.
Toomey, Frank.
Walker Mfg. Co.
Westinghouse Elec. & Mfg. Co.

**Electric Railways.**
Brush Electric Co.
Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B J.
Bain, Foree.
Bryan, Wm. H
Eddy Elec. Mfg. Co.
Schott, W. H.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bernardin, F. M,
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Electrical Specialties.**
Brodie Electric Co.
Commercial Elec. Sup. Co
Electric Protection Co.
Menominee El. & Mech. Co.
Phila. Elec. & Mfg. Co.
S. K. C. Specialty Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.
Weber Gas & Gaso'l Eng. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Ball Engine Co.
Chuse & Co., J. F.
Murray Iron Works Co.
Racine Hardware Co.
Toomey, Frank.
Weston Engine Co.

**Engravers.**
Chic. Electro & Stereo Co.

**Exhaust Pipe Heads.**
Faucett, I. L.

**Fan Motor and Lamp Guards.**
Inglis, Wm.

**Fan Outfits.**
Central Electric Co.
Emerson Elec. Mfg. Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co
Holmes Fibre-Graphite Co.
Kartavert Mfg. Co.
Vulcanised Fibre Co.

**Files.**
Barnett Co., G. & H.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Forges.**
Union Heater Supply Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gaskets.**
Peerless Rubber Mfg. Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Berliner Telephone Co.
Bernardin, F. M.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Metropolitan Electric Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.
Phila. Elec. & Mfg. Co.
Sioux City Brass Works.
S. K. C. Specialty Co.
Standard Tel. & Elec. Co.

**Globe Nets.**
Inglis, Wm.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Phoenix Glass Co.

**Gov'nors, Water Wheel.**
Lombard Water Wheel Gv. Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Beardsley Mfg. Co.
Bernardin, F. M.
Brixey, W. R.
Butler Hard Rubber Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Electric Appliance Co.
General Electric Co.

**Machinery Wipers.**
Am. Silk Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Manhole Covers.**
Greger Manhole Cover Co.

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Ferracute Machine Co.
Harrington, Son & Co., E.
Murray Iron Works Co.

**Mica.**
Bowers Bros.
Electrical Eng. Co.
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.
Schoonmaker, A. O.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co

**Motors.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Menominee El. & Mech. Co.
Roth Bros. & Co.
Sioux City Brass Works.
Southern El. Con. & Sup. Co.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Walker Mfg. Co.
Westinghouse El. & Mfg Co.

**Oil Feeders.**
Dailey, Jas. W.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.
Peerless Rubber Mfg. Co.

**Paints.**
MacCurdy & Smith.
Standard Paint Co.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co Ltd

**Platinum.**
Baker & Co.

**Poles.**
Bernardin, F. M.
Hart, C. S.
Lewis, A. L. & Co.
Lindsley Bros.
Morris, Tasker & Co.
Nuttall Co., R. D.
Perrizo, Paul, Jr. Co.

**Porcelain.**
Commercial Elec. Sup. Co.
Empire China Works.
General Electric Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.

**Speed Indicators.**
Besly & Co., Chas. H.
Weston Electrical Inst. Co
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Hess Storage Battery Co.
Ohio Storage Battery Co.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
Berliner Telephone Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Conn. Tel. & El. Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co
Gustafson, W. A.
Keystone Telephone Co.
Mason J. W.
Northwest Engineering Co.
Penn. Tel. Co.
Richards & Meacham.
Sill, A. D.
Standard Tel. & Elec. Co.
U. S. Tel. Const. Co.
Viaduct Mfg. Co.
Western Electric Co.

**Transformers.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Stanley Electric Mfg. Co.

**Trolley Cord.**
Bernardin, F. M.
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Cor. School of Technology
Int. Corr. Schools.

**Water Wheels.**
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Standard Underground C. Co

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**MENOMINEE, MICH.**

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No. 905.

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**MICA INSULATOR CO.,** Sole Manufacturers,

GENERAL OFFICE, 218 Water Street, NEW YORK.

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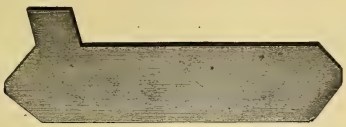
IT NEVER DISAPPOINTS

# Sole Western Distributers

FOR



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SEGMENTS, RINGS, TROUGHS.

The most perfect and economical of all the insulating materials. Besides the molded forms, we supply this in Boards, Sheets, Paper or Cloth. . .

....PROMPT SHIPMENTS....

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## Central Electric Company,

CHICAGO.

**BRANCHES:**

ST. LOUIS, Southern Electrical Supply Co.
BUFFALO, 112 White Building.
NEW ORLEANS, 1010 Canal Street.
KANSAS CITY, Gate City Electric Company.

### BUSINESS SHOULD IMPROVE.

It now is in order to expect a marked improvement in business conditions as a result of the success of the popular loan. The people have demonstrated in a practical way that they wish to have the parity preserved, and any doubts that may have existed in regard to that are removed by the offer to furnish between five and six times as much gold as was called for by the government. So there is the best of reason for confidence in the stability of the money unit, spite of all that the free silver extremists may or can do. Not only that, but the abundance of offerings indicates the existence of so much surplus gold that its payment into the Treasury will not necessitate any of the contraction of credits which some feared would be the result. The business current can flow along smoothly without any interruption. There is money enough for all legitimate operations and sufficient wealth of movable property to render it safe to grant all the credits needed to a considerable expansion of manufacturing and commercial activity.

The investment of capital in business enterprises has been discouraged in the recent past by more or less of apprehension that money returned might not be as good in buying power as that lent out or invested in goods to be sold on credit. There was no little domestic hesitancy on this point, and fears of stringency due to withdrawals of foreign capital tended much to restrict the volume of home business apart from what our own citizens might think on the subject. Now it is probable that foreign capital will be offered more freely, its volume available here being increased instead of diminished, and this feeling should make the domestic money market easier. The man who has money to lend at interest not only will have no fear of losing half of it by enforced shrinkage of the currency unit, but will cease to dread the trouble arising from its unprofitable employment by the borrower. Similarly the greater feeling of security may be expected to make the captains of commerce and industry more willing to hire the use of capital because of the better prospect for making a profit out of it, thus directly benefiting the working classes by finding them more to do, tending to increase their remuneration and enabling them to increase the demand for other labor.

The first half of February usually is the flattest time of the year in the labor market. It normally marks the minimum of work to be done, the lowest prices in the markets for the cereals, the offering at reduced figures of unsold manufactured goods that had been taken in stock for the winter trade. It was the time of greatest depression in the wages of labor in this and other cities after the panics of 1893. Other conditions not forbidding, there always is room to look for improvement soon after this date in the year. The satisfactory settling of affairs in the money situation gives additional reason to expect this improvement for 1896. From this time on there should be a marked widening in the demand for labor and its products, marking the advent of better industrial and commercial conditions and greater comfort to the people as a whole.—*Chicago Tribune.*

A writer in the Pittsburg *Dispatch* suggests that the construction of battle-ships and great guns be stopped, and reliance placed in the electrical explosion of nitro-glycerine in great quantities. He says that 100 barrels of the substance, placed, at a cost of $20,000, in a tank on a small light vessel, and exploded at any given point on the water, would have deadly effect within a circle of four miles radius, the atmospheric pressure combined with the enormous resulting wave insuring the destruction of every floating thing.

# NOTICE.

The Siemens & Halske Electric Co. of America, among numerous patents, owns United States patent No. 417,668, Dec. 17, 1889, on what is usually termed

## "THE DIRECT-CURRENT BOOSTER."

Both in central lighting stations and railway stations, where a large amount of current has to be transmitted to points at considerable distances from the power house, it becomes absolutely necessary to adopt some means of cutting down the enormous amount of copper needed if this part of the system is to be practical from a financial standpoint.

American Electrical Engineers have not been slow in recognizing this fact, and they have availed themselves in many instances of the direct-current "Booster" system.

To take an actual case: In laying out a feeder system in a certain city it was found that several of the lines extend from 5 to 7 miles from the station, and have a very large summer excursion travel to the parks located at the ends. To handle this occasional load satisfactorily by the direct-feeder system at such distances would have required an enormous outlay of copper. A direct-current "Booster" solved the problem satisfactorily at a small cost. J. B. Scott, in a paper published in the "Street Railway Review" for January, shows, for instance, that to feed 675 amperes 7 miles about $65,000 worth of copper may be saved by employing a "Booster."

The Siemens & Halske Electric Co. of America absolutely control this fundamental "Booster" patent, and two wealthy electric illuminating companies in two of the principal cities of the United States, after thorough investigation, have already acknowledged the validity of this patent and made arrangements to operate "Boosters" under a license from the Siemens & Halske Electric Co. All users of this system are again warned, as they will be prosecuted unless they make amicable adjustment.

The Siemens & Halske Electric Co. are prepared to furnish the necessary apparatus and license customers under the patent mentioned above, and will be pleased to communicate with prospective customers concerning licenses under any of the numerous patents which it owns.

## SIEMENS & HALSKE ELECTRIC CO. OF AMERICA,

**Monadnock Block, - - - Chicago.**

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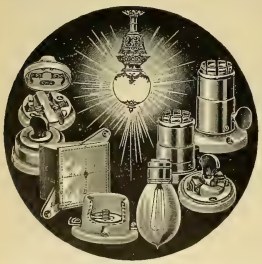

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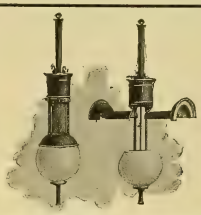

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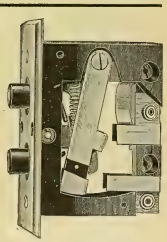

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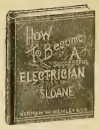


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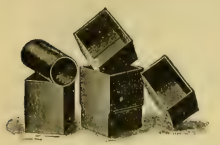

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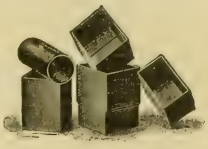

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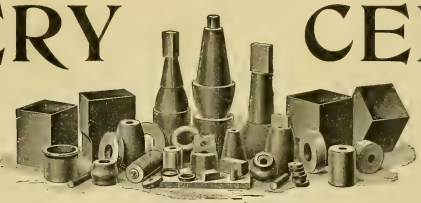

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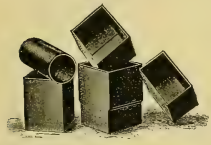

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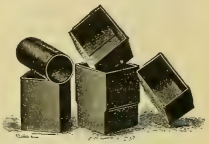

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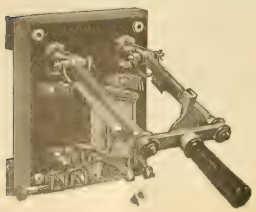

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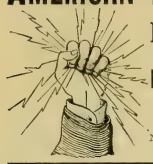

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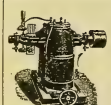

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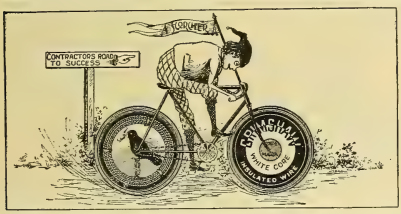


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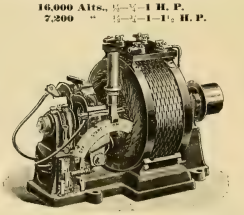

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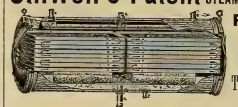

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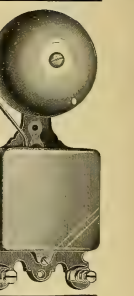

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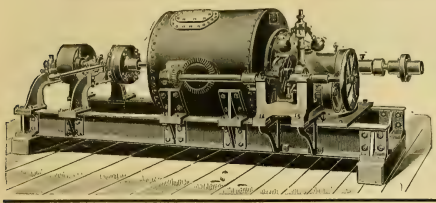

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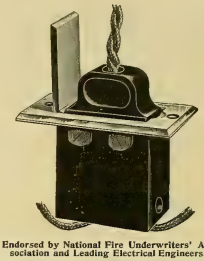

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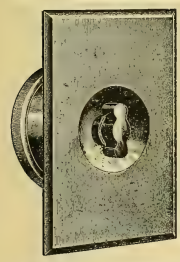

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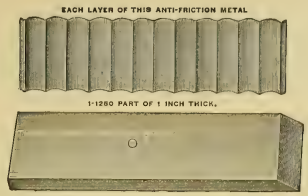

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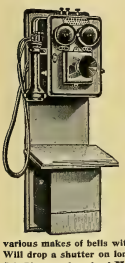

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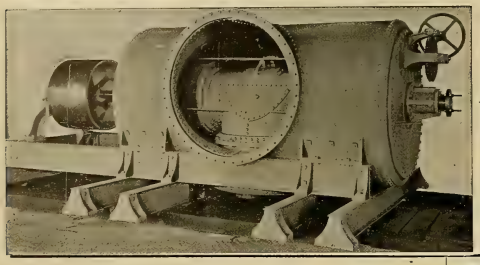

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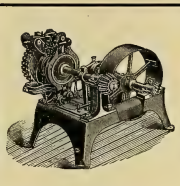

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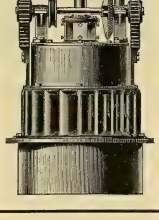

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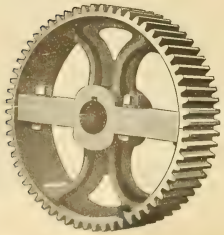

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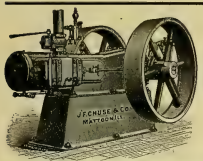

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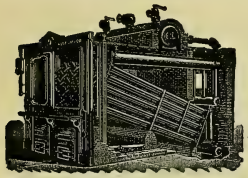

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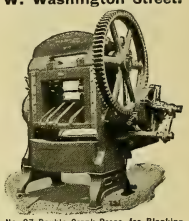

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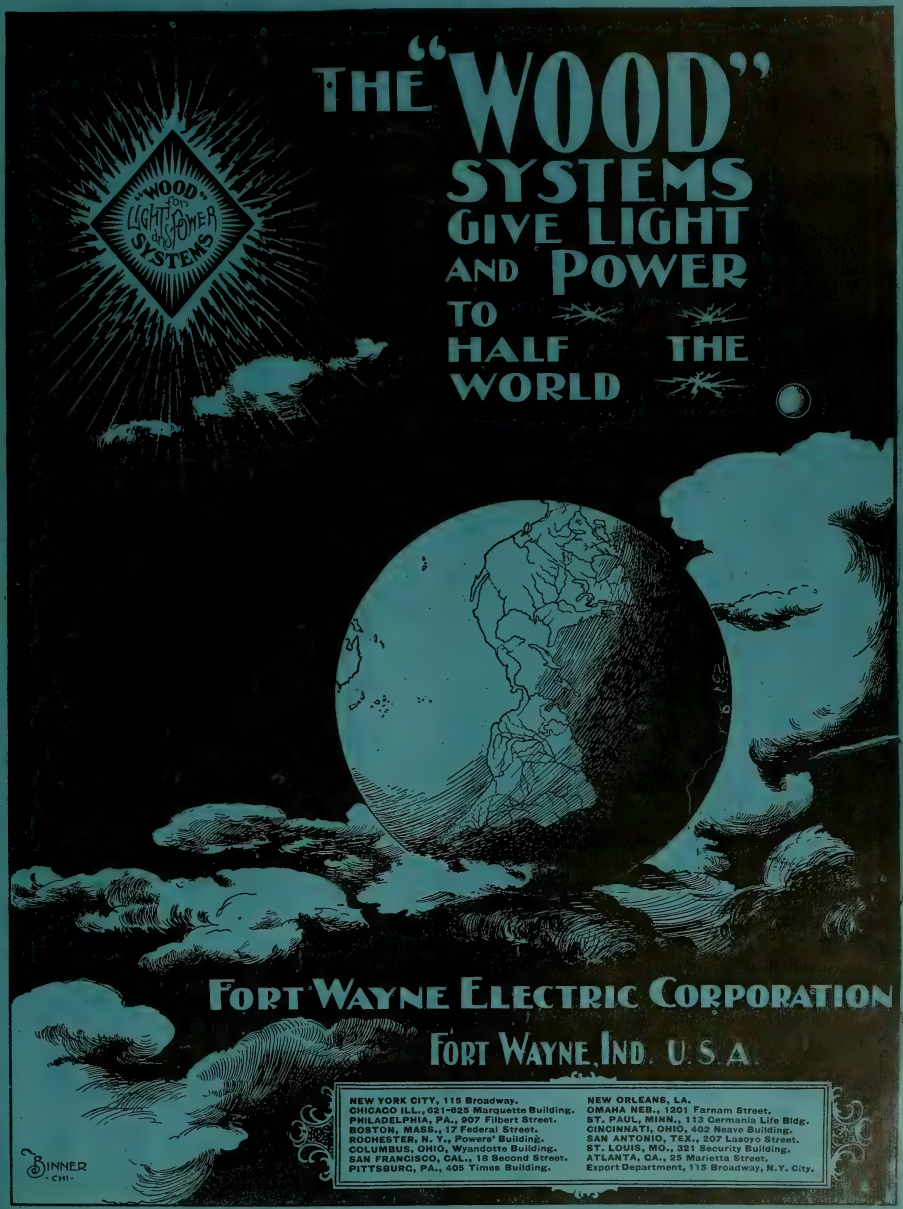
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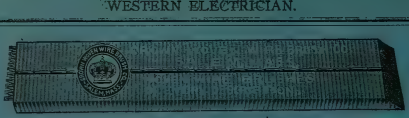

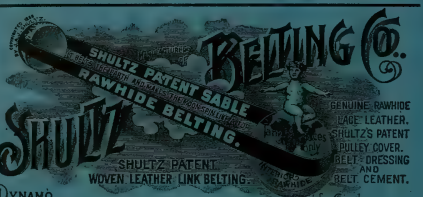


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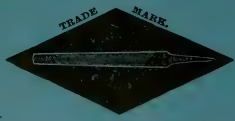


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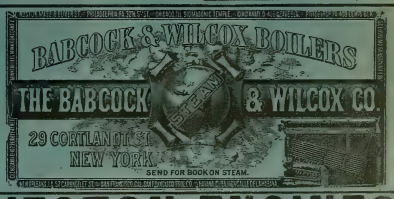


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## CLASSIFIED LIST.


**Accumulators.**
American Battery Co.
Electric Storage Battery Co.
Hess Storage Battery Co.
Ohio Storage Battery Co.

**Annunciators.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
Mason, J. W.
Menominee El. & Mech. Co.
Partrick & Carter Co.

**Arc Lamps.**
Adams-Bagnall Elec. Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Fleming-Spence Elec. Co.
Ft. Wayne Elec. Corporation.
Perkins Elec. Switch Mfg. Co.
Van Nuis, C. S.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Boynton Multivolt Batt'y Co.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Storage Battery Co.
Gordon-Burnham Bat. Co.
Leclanche Battery Co., The.
Mason, J. W.
Menominee El. & Mech. Co.
Newton Rubber Wks.
Northwest Engineering Co.
Ohio Storage Battery Co.
Partrick & Carter Co.
Western Electric Co.

**Bells.**
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
National Electric Co.
Partrick & Carter Co.
Washington Electric Co.
Western Electric Co.

**Belting.**
Channon Co., H.
Chicago Belting Co.
Jewell Belting Co.
Rhoads & Sons, J. E.
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Collins & Co., H. E.
Moyes, L. M.
Murray Iron Works Co.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Bernardin, F. M.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Crown Woven Wire Brush Co.
Holmes Fibre-Graphite Co.
Mason, J. W.
Phila. Elec. & Mfg. Co.
Partridge Carbon Co.
S. K. C. Specialty Co.
Solar Carbon & Mfg. Co.
Wirt, Chas.
Youngiove & Gere.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Electric Works.
Brixey, W. R.
Central Electric Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Nat'l Underground Cable Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Carbons, Points & Plates.**
American Carbon Co.
Bernardin, F. M.
Central Electric Co.
Chicago Gen'l Fixture Co.
General Electric Co.
Mason, J. W.
Partridge Carbon Co.
Reisinger, Hugo.
Solar Carbon & Mfg. Co.
Wertheim, Ed.
Western Electric Co.

**Cigar Lighters.**
National Electric Co.

**Compound.**
S. K. C. Specialty Co.
Standard Paint Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.
McRoy, Jno. T.

**Construction & Repairs.**
Bernardin, F. M.
Ft. Wayne Elec. Corporation.
Richards & Meacham.

**Contractors and Electric Light Plants.**
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan, Wm. H.
Card Electric Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Schott, W. H.
Siemens & Halske Elec. Co.
United Elec. Improvement Co.
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**

**Copper Wires.**
American Electrical Works.
Bernardin, F. M.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Menominee El. & Mech. Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cranes.**
Harrington, Son & Co., E.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Bernardin, F. M.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Mason, J. W.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bernardin, F. M.
Brodie Electric Co.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
Phila. Elec. & Mfg. Co.
S. K. C. Specialty Co.
Washington Electric Co.

**Dynamos.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
Electrical Eng. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Siemens & Halske Elec. Co.
Toomey, Frank.
Walker Mfg. Co.
Westinghouse Elec. & Mfg. Co.

**Electric Railways.**
Brush Electric Co.
Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryan, Wm. H.
Eddy Elec. Mfg. Co.
Schott, W. H.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bernardin, F. M.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Washington Electric Co.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Electrical Specialties.**
Brodie Electric Co.
Commercial Elec. Sup. Co.
Electric Protection Co.
Menominee El. & Mech. Co.
Phila. Elec. & Mfg. Co.
S. K. C. Specialty Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.
Weber Gas & Gaso'l Eng. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Ball Engine Co.
Chuse & Co., J. F.
Murray Iron Works Co.
Racine Hardware Co.
Toomey, Frank.
Weston Engine Co.

**Engravers.**
Chic. Electro & Stereo Co.

**Exhaust Pipe Heads.**
Faucett, I. L.

**Fan Motor and Lamp Guards.**
Inglis, Wm.

**Fan Outfits.**
Central Electric Co.
Emerson Elec. Mfg. Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Holmes Fibre-Graphite Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

**Files.**
Barnett Co., G. & H.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gaskets.**
Peerless Rubber Mfg. Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Berliner Telephone Co.
Bernardin, F. M.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Metropolitan Electric Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.
Phila. Elec. & Mfg. Co.
Sioux City Brass Works.
S. K. C. Specialty Co.
Standard Tel. & Elec. Co.
Washington Electric Co.

**Globe Nets.**
Inglis, Wm.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Phoenix Glass Co.

**Governors, Water Wheel.**
Lombard Water Wheel Gv. Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Beardsley Mfg. Co.
Bernardin, F. M.
Brixey, W. R.
Butler Hard Rubber Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
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Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
Nat'l Underground Cable Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
New York & Ohio Co.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Electric Appliance Co.
General Electric Co.

**Machinery Wipers.**
Am. Silk Mfg. Co.

**Magnet Wire**
(See Insulated Wires.)

**Manhole Covers.**
Greger Manhole Cover Co.

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Ferracute Machine Co.
Harrington, Son & Co., E.
Murray Iron Works Co.

**Mica.**
Bowers Bros.
Electrical Eng. Co.
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.
Schoonmaker, A. O.

**Mining Apparatus, Elec.**
General Electric Co.

**Motors.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Menominee El. & Mech. Co.
Roth Bros. & Co.
Sioux City Brass Works.
Southern El. Con. & Sup. Co.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Walker Mfg. Co.
Westinghouse El. & Mfg. Co.

**Oil Feeders.**
Dailey, Jas. W.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.
Peerless Rubber Mfg. Co.

**Paints.**
MacCurdy & Smith.
Standard Paint Co.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd.

**Platinum.**
Baker & Co.

**Poles.**
Bernardin, F. M.
Hart, C. S.
Lewis, A. L. & Co.
Lindsley Bros.
Morris, Tasker & Co.
Nuttall Co., R. D.
Perrizo, Paul, Jr. Co.

**Porcelain.**
Commercial Elec. Sup. Co.
Empire China Works.
General Electric Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.

**Speed Indicators**
Besly & Co., Chas. H.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Hess Storage Battery Co.
Ohio Storage Battery Co.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
Berliner Telephone Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Conn. Tel. & El. Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co.
Gustafson, W. A.
Keystone Telephone Co.
Mason, J. W.
Northwest Engineering Co.
Richards & Meacham.
Sill, A. D.
Standard Tel & Elec. Co.
U. S. Tel. Const. Co.
Viaduct Mfg. Co.
Western Electric Co.

**Transformers.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation
General Electric Co.
Stanley Electric Mfg. Co.

**Trolley Cord**
Bernardin, F. M.
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Cor. School of Technology.
Int. Corr. Schools.

**Water Wheels.**
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.

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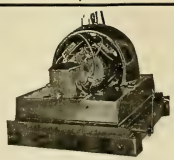
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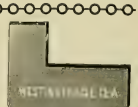
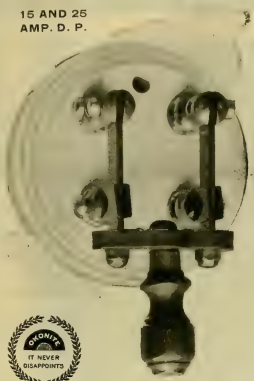
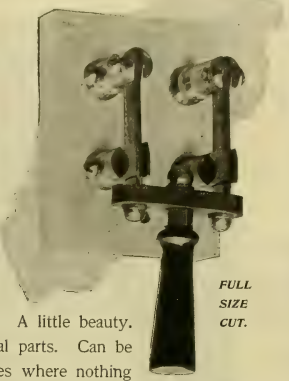


15 AND 25
AMP. D. P.





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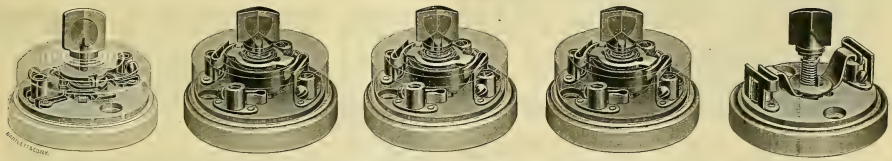
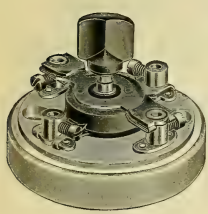
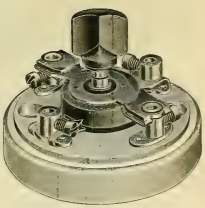


## ...CAUTION...

All Hart Switches have always had

## "Hart Switch"





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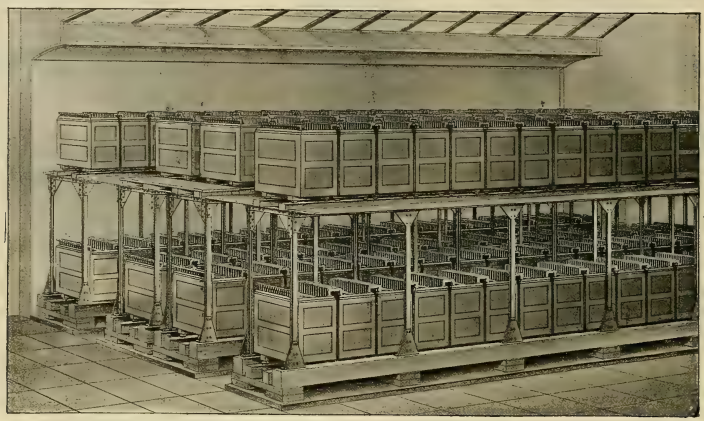

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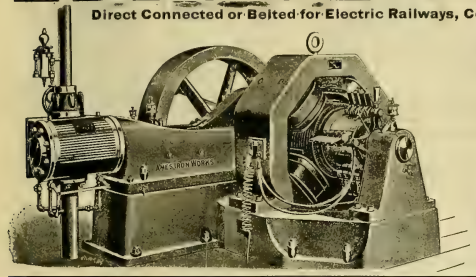

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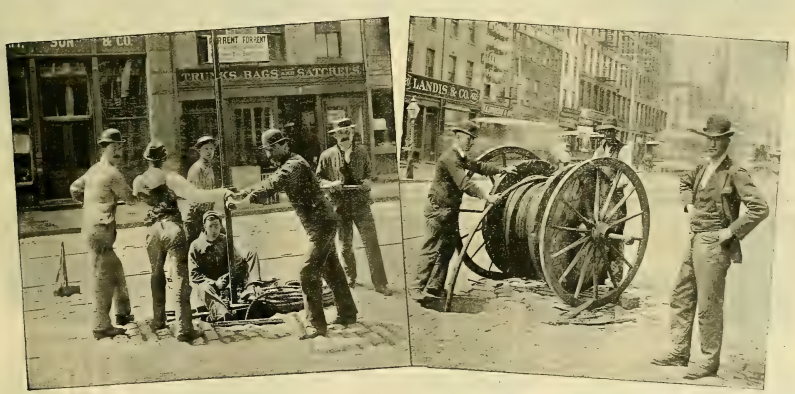


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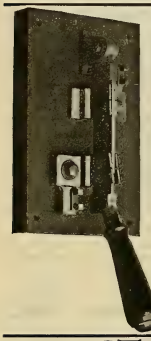

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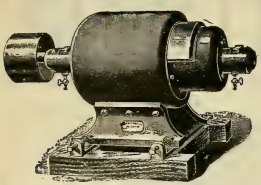

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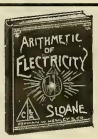


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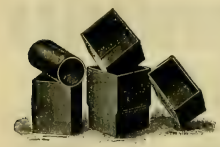

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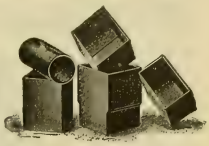

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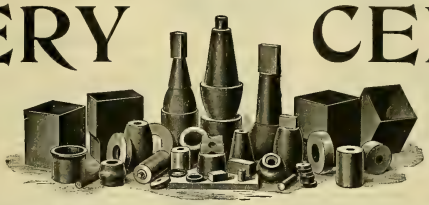

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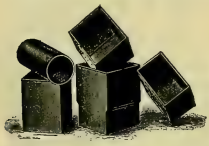

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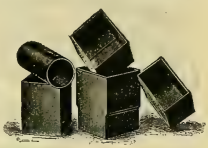

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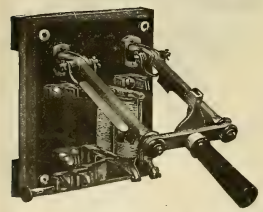

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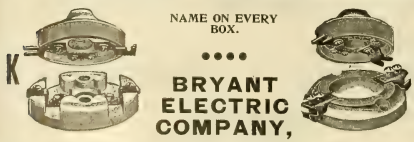


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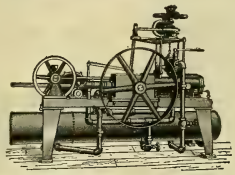

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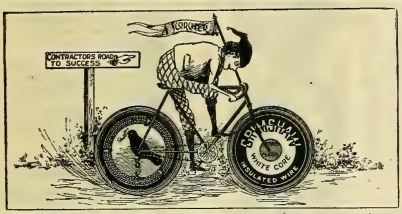


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Sealed bids will be received at this office until 12 o'clock noon, Wednesday, March 18th, 1896, for lighting the City of Lexington with gas, incandescent light or electric arc light, as specified by specifications that will be mailed on application. Also bids will be received for the building of a municipal electric arc plant for the City of Lexington, according to specifications that will be mailed upon application.

The said bids will be opened by the joint committee on light and water of the General Council at noon, March 18th, 1896.

This committee reserves the right to reject any and all bids.

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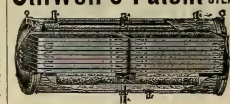

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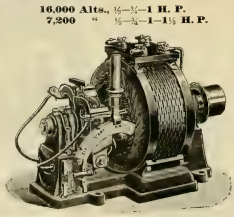

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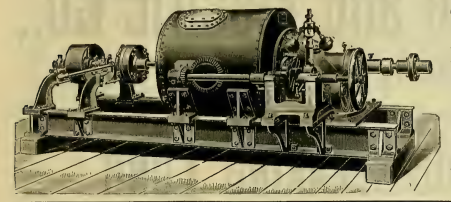

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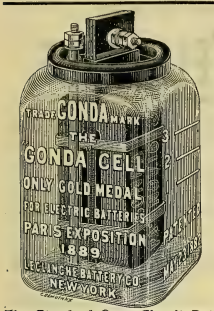


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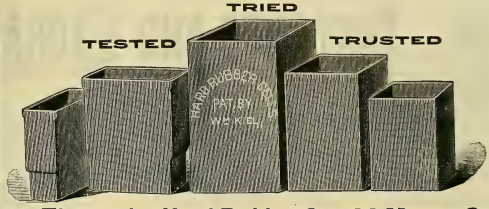


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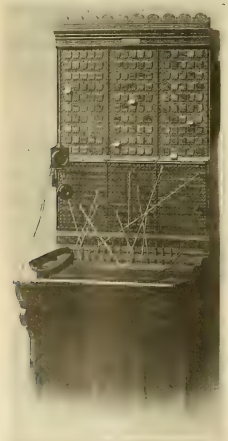

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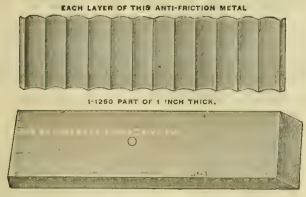


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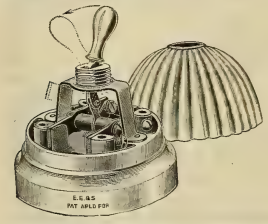

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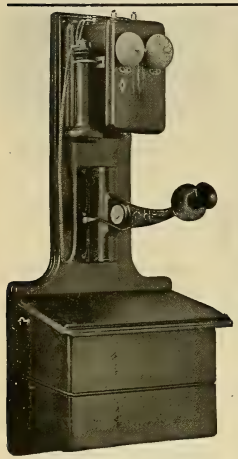

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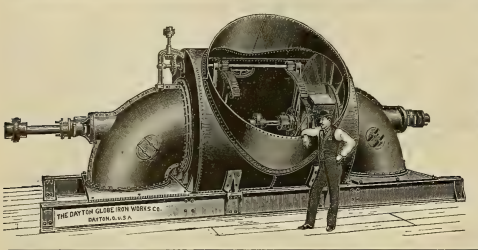


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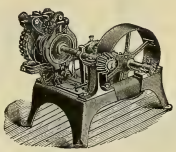

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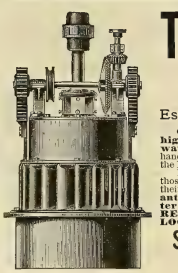

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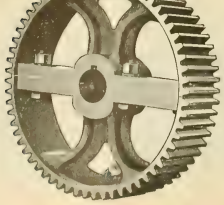

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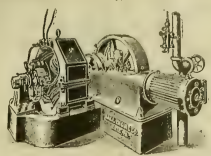

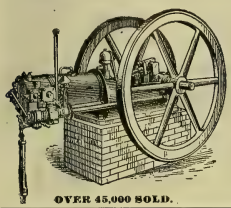

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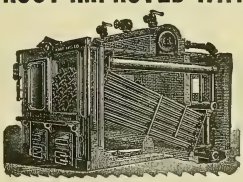

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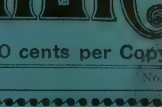


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Central Electric Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Washington Electric Co.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Electrical Specialties.**
Brodie Electric Co.
Commercial Elec. Sup. Co
Electric Protection Co.
Menominee El. & Mech. Co.
Phila. Elec. & Mfg. Co.
S. K. C. Specialty Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.
Weber Gas & Gaso'l Eng. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Ball Engine Co.
Chuse & Co., J. F.
Murray Iron Works Co.
Racine Hardware Co.
Toomey, Frank.
Weston Engine Co.

**Engravers.**
Chic. Electro & Stereo Co.

**Exhaust Pipe Heads.**
Faucett, I. L.

**Fan Motor and Lamp Guards.**
Inglis, Wm.

**Fan Outfits.**
Central Electric Co.
Emerson Elec. Mfg. Co.
Interior Conduit & Ins. Co
Roth Bros. & Co.
Westinghouse El. & Mfg. Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Holmes Fibre-Graphite Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

**Files.**
Barnett Co., G. & H.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gaskets.**
Peerless Rubber Mfg. Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Berliner Telephone Co.
Bernardin, F M.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Metropolitan Electric Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.
Phila. Elec. & Mfg. Co.
Sioux City Brass Works.
S. K. C. Specialty Co.
Standard Tel. & Elec. Co.
Washington Electric Co.
Westinghouse El. & Mfg. Co

**Globe Nets.**
Inglis, Wm.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Phoenix Glass Co.

**Governors, Water Wheel.**
Lombard Water Wheel Gv. Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Beardsley Mfg. Co.
Bernardin, F. M.
Brixey, W. R.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C.Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
Nat'l Underground Cable Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C.Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Electric Appliance Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Manhole Covers.**
Greger Manhole Cover Co.

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Ferracute Machine Co.
Murray Iron Works Co.

**Mica.**
Bowers Bros.
Electrical Eng. Co.
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.
Schoonmaker, A. O.

**Mining Apparatus, Elec.**
General Electric Co.

**Motors.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Menominee El. & Mech. Co.
Roth Bros. & Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Walker Mfg. Co.
Westinghouse El. & Mfg Co

**Oil Feeders.**
Dailey, Jas. W.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.
Peerless Rubber Mfg. Co.

**Paints.**
MacCurdy & Smith.
Standard Paint Co.

**Phosphor Bronze.**
Phosphor Bronze Sm.Co Ltd

**Platinum.**
Baker & Co.

**Poles.**
Bernardin, F. M.
Hart, C. S.
Lindsley Bros.
Morris, Tasker & Co.
Nuttall Co., R. D.
Perrizo, Paul, Jr. Co.

**Porcelain.**
Commercial Elec. Sup. Co
Empire China Works
General Electric Co.

**Publishers, Electrical.**
Electrician Publishing Co

**Push Buttons.**
Central Electric Co.
Electric Appliance Co
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co
Westinghouse El. & Mfg. Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.

**Speed Indicators.**
Besly & Co., Chas. H.
Weston Electrical Inst. Co
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Hess Storage Battery Co.
Ohio Storage Battery Co.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
Berliner Telephone Co.
Central Electric Co.
Commercial Elec. Sup. Co.
Conn. Tel. & El. Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co
Gustafson, W. A.
Keystone Telephone Co.
Mason J. W.
Northwest Engineering Co.
Richards & Meacham.
Sill, A. D.
Standard Tel. & Elec. Co.
Viaduct Mfg. Co.
Western Electric Co.

**Transformers.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation
General Electric Co.
Stanley Electric Mfg. Co
Westinghouse El. & Mfg. Co.

**Trolley Cord.**
Bernardin, F. M.
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

**Universities.**
Cor. School of Technology.
Int. Corr. Schools.

**Water Wheels.**
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.

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**Accumulators.**
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Electric Storage Battery Co.
Hess Storage Battery Co.
Ohio Storage Battery Co.

**Annunciators.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
Mason, J. W.
Menominee El. & Mech. Co.
Partrick & Carter Co.

**Arc Lamps.**
Adams-Bagnall Elec. Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Fleming-Spence Elec. Co.
Ft. Wayne Elec. Corporation.
Perkins Elec. Switch Mfg. Co.
Van Nuis, C. S.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Boynton Multivolt Batt'y Co.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Edgerton Pottery Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Storage Battery Co.
Gordon-Burnham Bat. Co.
Loclanche Bat. Co.
Partrick & Carter Co.
Western Electric Co.

**Belts.**
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech Co.
National Belting Co.
Partrick & Carter Co
Washington Elec. Co.
Western Electric Co.

**Belting.**
Channon Co., H.
Chicago Belting Co.
Jewell Belting Co.
Rhoads & Sons, J. E.
Shults Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Collins & Co., H. E.
Moyes, L. M.
Murray Iron Works Co.
Reisinger, Hugo.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Bernardin, F. M.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Crown Woven Wire Brush Co.
Holmes Fibre Graphite Co.
Mason, J. W.
Phila. Elec. & Mfg. Co.
Partridge Carbon Co.
S. K. C. Specialty Co.
Solar Carbon & Mfg. Co.
Wirt, Chas.
Youngiove & Gere.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Mason, J. W.
New York Ins. Wire Co
Nat'l Underground Cable Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Carbons, Points & Plates.**
American Carbon Co.
Bernardin, F. M.
Central Electric Co.
Chicago Gen'l Fixture Co.
General Electric Co.
Mason, J. W.
Partridge Carbon Co.
Reisinger, Hugo.
Schiff, Jordan & Co.
Solar Carbon & Mfg. Co.
Standard Paint Co.
Wirt, Chas.
Western Electric Co.

**Cigar Lighters.**
National Electric Co.

**Compound.**
S. K. C. Specialty Co.
Van Nuis, C. S.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.
McKoy, Jno. T.

**Construction & Repairs.**
Bernardin, F. M.
Ft. Wayne Elec. Corporation.
Richards & Mecham.

**Contractors and Electric Light Plants.**
Arnold, B. J.
Bain, Force.
Brush Electric Co.
**Bryan, Wm. H.**
Card Electric Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Schoen, W. H.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec. & Mfg. Co.
Western Electric Co.

**Copper.**
American Electrical Works.
Bernardin, F. M.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Menominee El. & Mech. Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Copper Wires.**
American Electrical Works.
Bernardin, F. M.
Besly & Co., Chas. H.
Brixey, W. R.
Central Electric Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Menominee El. & Mech. Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Bernardin, F. M.
Brady, T. H.
Central Electric Co.
Mason, J. W.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Mason, J. W.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bernardin, F. M.
Brodie Electric Co.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
Phila. Elec. & Mfg. Co.
S. K. C. Specialty Co.
Washington Electric Co.
Westinghouse El. & Mfg. Co.

**Dynamos.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Co.
Eddy Elec. Mfg. Co.
Electrical Eng. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Siemens & Halske Elec. Co.
Toomey, Frank.
Walker Mfg. Co.
Westinghouse Elec. & Mfg. Co.

**Electric Railways.**
Brush Electric Co.
Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Force.
Bryan, Wm. H.
Eddy Elec. Co.
Schott, W. H.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bernardin, F. M.
Central Electric Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Washington Electric Co.
Weston Electrical Inst. Co.
Western Electric Co.

**Electrical Specialties.**
Brodie Electric Co.
Commercial Elec. Sup. Co.
Electric Protection Co.
Siemens & Halske Elec. Co.
Phila. Elec. & Mfg. Co.
S. K. C. Specialty Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.
Weber Gas & Gaso. Eng. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Ball Engine Co.
Chuse & Co., J. F.
Murray Iron Works Co.
Racine Hardware Co.
Toomey, Frank.
Weston Engine Co.

**Engravers.**
Chicago Elec. & Stereo Co.

**Exhaust Pipe Heads.**
Ingils, Wm.

**Fan Motor and Lamp Guards.**
Ingils, Wm.

**Fan Outfits.**
Century Electric Co.
Emerson Elec. Mfg. Co.
Interior Conduit & Ins. Co
Roth Bros. & Co.
Westinghouse El. & Mfg. Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Holmes Fibre-Graphite Co.
Karlsvert Mfg. Co.
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Independent Electric Co.

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**Gears.**
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Nuttall Co., R. D.

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Bernardin, F. M.
Besly & Co., Chas. H.
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Bryant Electric Co.
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Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
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Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
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General Electric Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Nuttall Co., R. D.
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Phila. Elec. & Mfg. Co.
S. K. C. Specialty Co.
Siemens & Halske Elec. Co.
Standard Underground C. Co.
Van Nuis, C. S.
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Dixon Crucible Co., Jos.
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Besly & Co., Chas. H.
Bernardin, F. M.
Brixey, W. R.
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Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Manville Co., H. W.
Karlsvert Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
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Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
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Simplex Electrical Co.
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Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
Nat'l Underground Cable Co.
New York Insulated Wire Co.
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Moore, Alfred F.
New York Insulated Wire Co
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Besly & Co., Chas. H.
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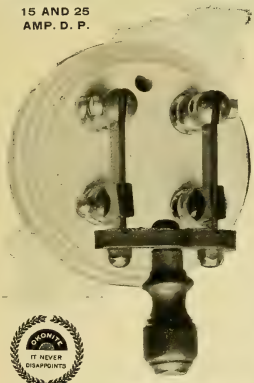

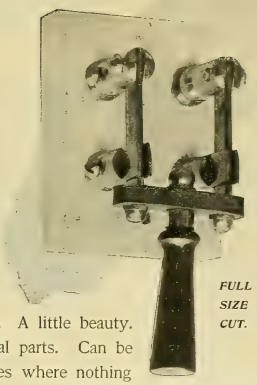

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UNDER THE AUSPICES OF AND IN CONNECTION WITH THE

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OF THE

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**May 4th**
...TO...
**May 30th,**
**Inclusive,**
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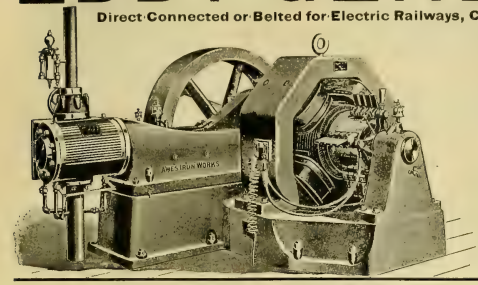

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**We organize State Companies to manufacture and install electric lighting plants, with gas engine, dynamo and storage battery.**
**Territorial rights granted. Patents in all countries.**

**The first successful Non-infringing Storage Battery ever produced in the United States. Note the contrast from the Supreme Court decision:**

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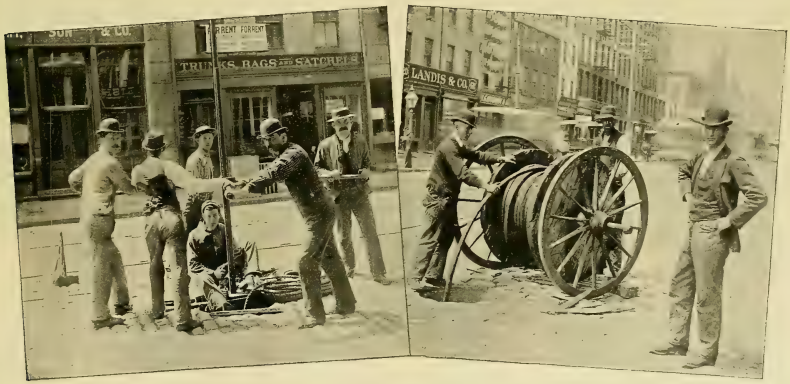


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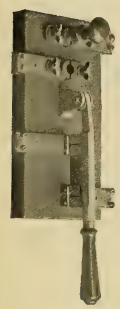

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**Not Expensive.**
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**INCANDESCENT LAMPS**

QUALITY UNEQUALED.

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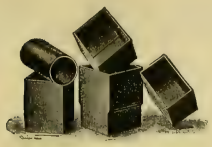

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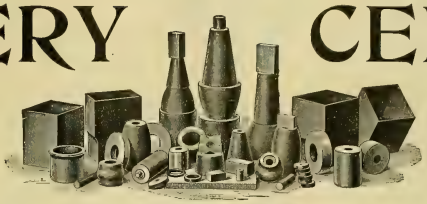

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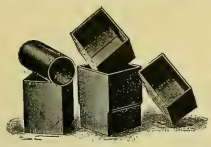

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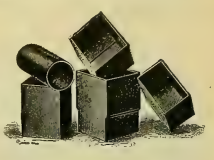

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Sales Offices in all Large Cities of the United States.

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TEACHER:—"Why is this not a Packard Lamp?"
SMALL BOY:—"Because there are no flies on the Packard Lamp."
TEACHER:—"That is right, you may go to the head of the class."

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To learn that the PACKARD LAMP is the best all-around lamp that has ever been produced.

**Electric Appliance Company,**
...ELECTRICAL SUPPLIES...
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HAVE YOU USED IT?

Oils, Ammonia or Alkalies do not affect it.

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NO BAKING OR FOLLOWING UP.
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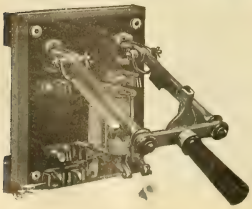

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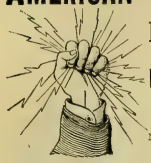

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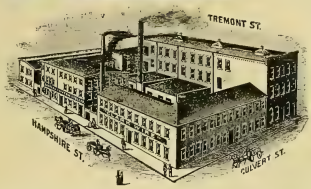


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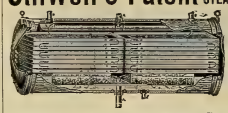

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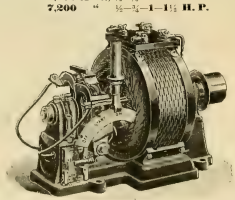

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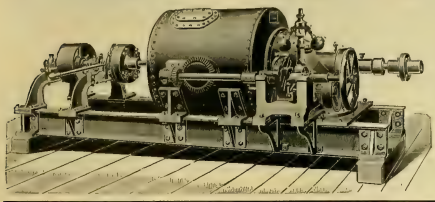

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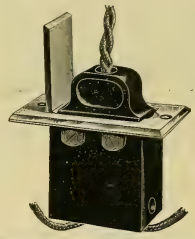

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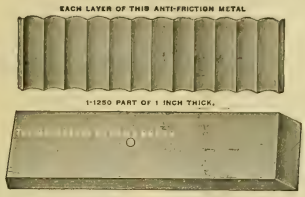

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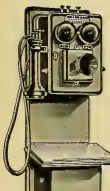

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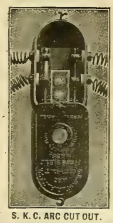

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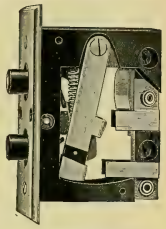

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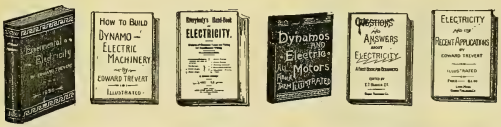


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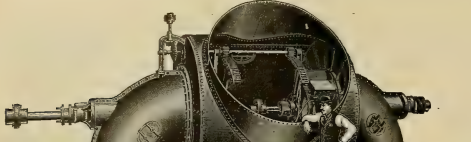


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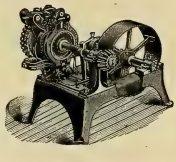

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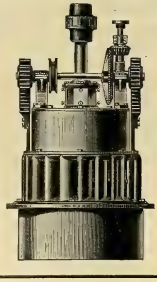

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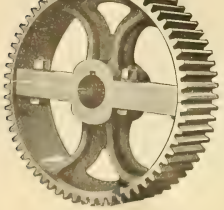

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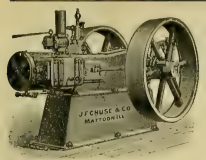


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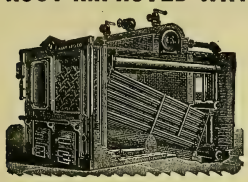

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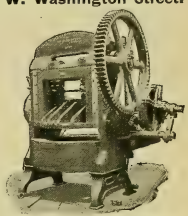

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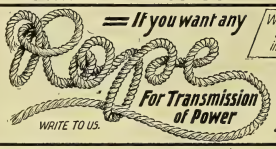


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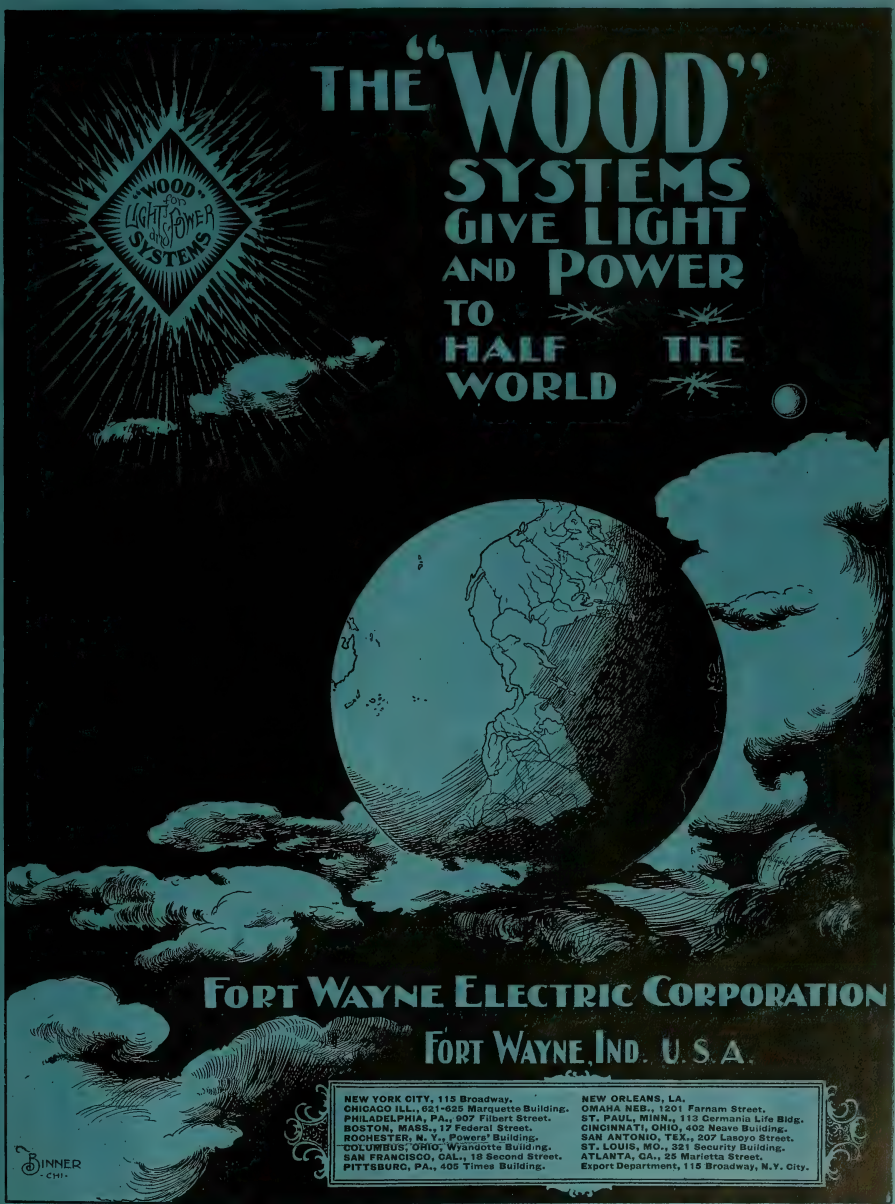
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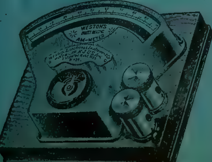

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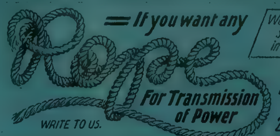

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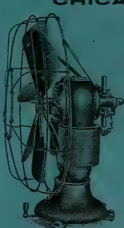

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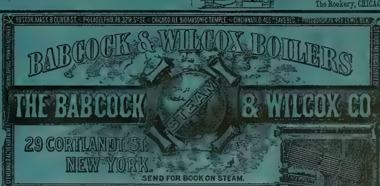


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**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gaskets.**
Peerless Rubber Mfg. Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
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Nuttall Co., R. D.

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Bernardin, F. M.
Besly & Co., Chas. H.
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Bryant Electric Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
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Cutter El. & Mfg. Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
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Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Metropolitan Electric Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.
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Sioux City Brass Works.
S. K. C. Specialty Co.
Standard Tel. & Elec. Co.
Washington Electric Co.
Westinghouse El. & Mfg. Co.

**Globe Nets.**
Inglis, Wm.

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Phoenix Glass Co.

**Governors, Water Wheel.**
Lombard Water Wheel Gv. Co.

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Holmes Fibre-Graphite Co.

**Hard Rubber Goods.**
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Fiberite Co., The.
Newton Rubber Wks.

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Beardsley Mfg. Co.
Bernardin, F. M.
Brixey, W. R.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Insulated Wires and Cables—Magnet Wire.**
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Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
Nat'l Underground Cable Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

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Buckeye Electric Co.
Central Electric Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
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Ft. Wayne Elec. Corporation.
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Ferracute Machine Co.
Murray Iron Works Co.

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Card Electric Co.
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Colburn El. Mfg. Co.
Eddy Elec. Mfg. Co.
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Electrical Eng. Co.
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Garlock Packing Co.
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Standard Paint Co.

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Phosphor Bronze Sm. Co Ltd

**Platinum.**
Baker & Co.

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DeWitt Brown Cedar Co,
Hart, C. S.
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Morris, Tasker & Co.
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Empire China Works.
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Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

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Electric Appliance Co.
Partrick & Carter Co.
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Conn. Tel. & El. Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co
Gustafson, W. A.
Keystone Telephone Co.
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Besly & Co., Chas. H.
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Long Life, Efficiency,
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It is Absolutely Non Freezing,
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Superior Generation of Energy.

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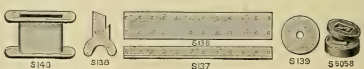


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Generators for Power Transmission or Isolated Lighting.
CARD Generators are all Multipolar and Slow Speed.

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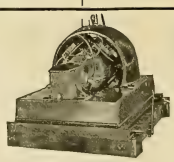

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NOTE.—We do no construction work of any description, therefore do not come in conflict with our patrons in any manner. No doubt contractors and others who have found themselves bidding against their source of supplies will appreciate our unique position.

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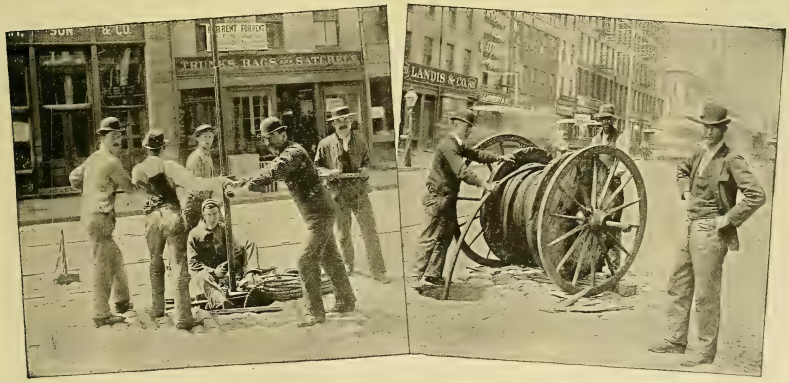


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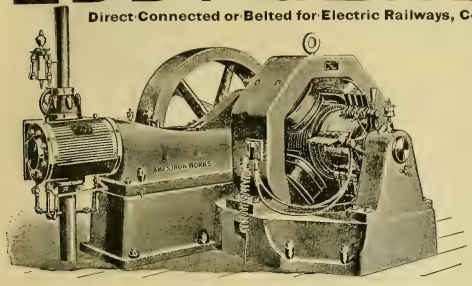

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**We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.**

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**Is practically indestructible.**
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**Buckling is absolutely prevented, not by resistant force but by a scientific new process.**

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**The first successful Non-infringing Storage Battery ever produced in the United States. Note the contrast from the Supreme Court decision:**

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New Face Plate.

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Better Design,
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No Breaking,

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Single Plates for all sizes of Hart Switches.
Gang Plates for any number of Hart Switches.

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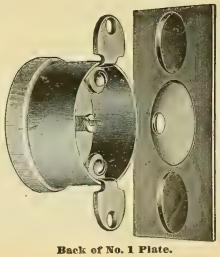

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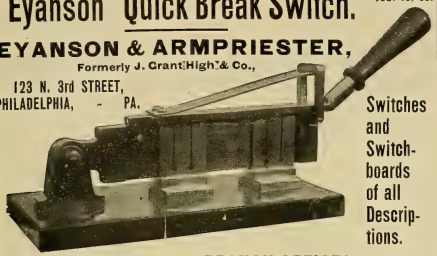

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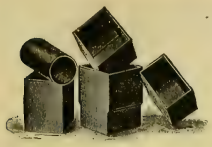

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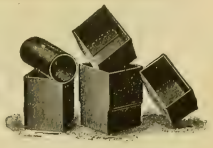

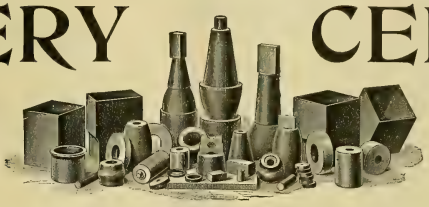

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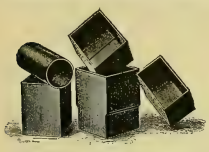

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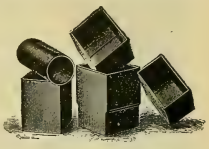

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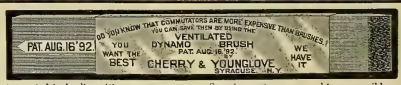


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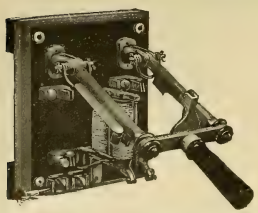

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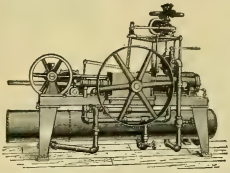

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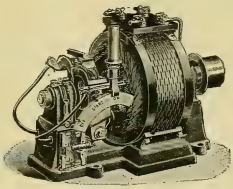

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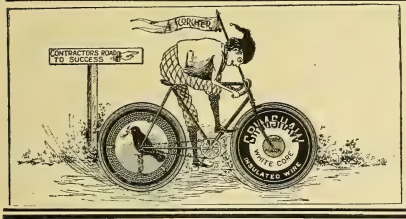


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Sealed bids will be received at this office until 12 o'clock noon, Wednesday, March the 18th, 1896, for lighting the City of Lexington with gas, incandescent light or electric arc light, as specified by specifications that will be mailed on application. Also bids will be received for the building of a municipal electric arc plant for the City of Lexington, according to specifications that will be mailed upon application.

The said bids will be opened by the proper committee on light and water of the General Council at noon, March 18th, 1896.

The committee reserves the right to reject any and all bids.

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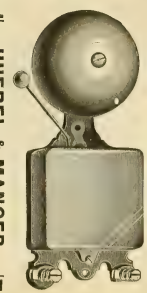

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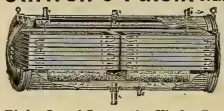

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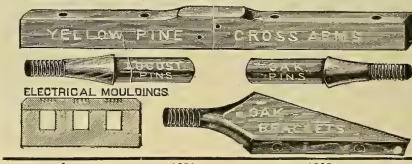


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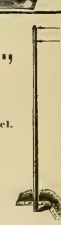

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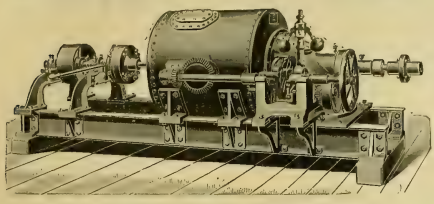

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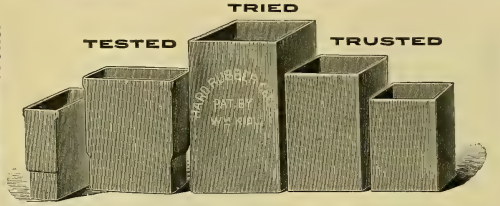


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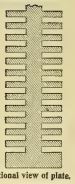

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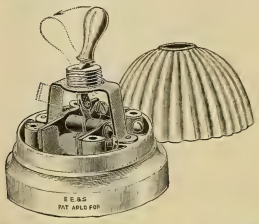


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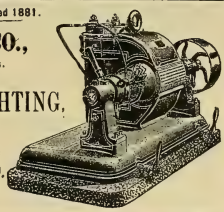

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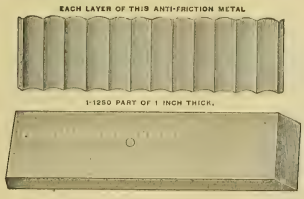


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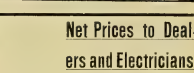

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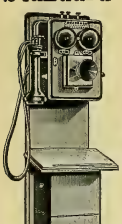

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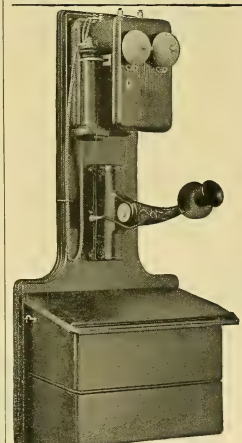

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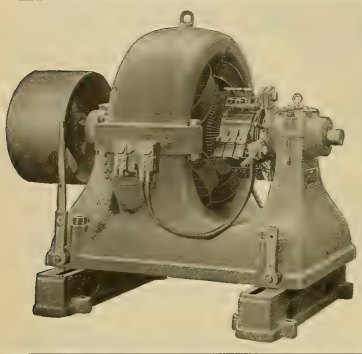

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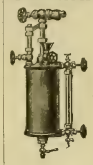
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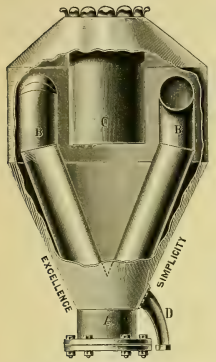

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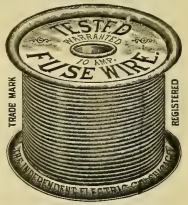

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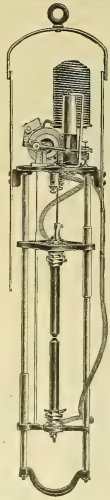
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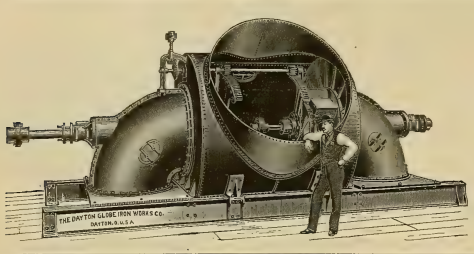


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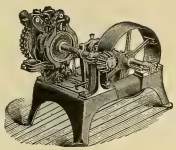

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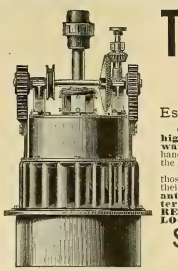

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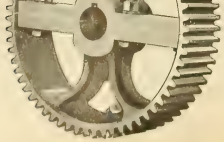

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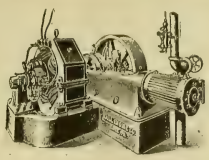

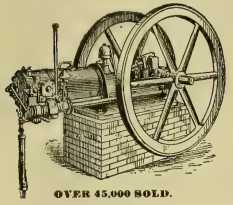

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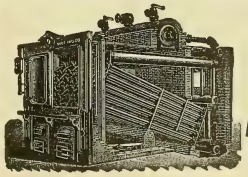

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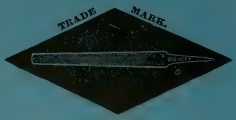


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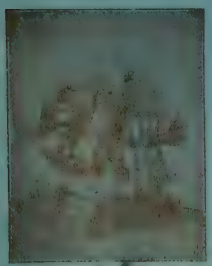

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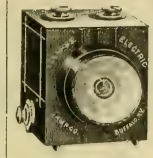

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# HARDTMUTH CARBONS,

**Cored and Solid for Direct Lighting.**

## ...LARGE IMPORTATION JUST ARRIVED...

General Western Agents:

## Chicago Edison Company,

**..DEALERS IN ELECTRIC LIGHTING SUPPLIES..**

**Edison Building, 139 Adams Street, CHICAGO, ILL.**

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## *JUST NOW*

Is the time to decide on the Fan Motor you intend to handle this season. Our direct current motor is equal to the best, if its intrinsic merit is considered.

## Annunciators, Medical Farradic Batteries.

MAGNETO, HAND AND POWER

**...GENERATORS...**

**INDUCTION AND SPARK COILS, ETC., ETC.**

**WRITE FOR CATALOGUE**

## Menominee Electrical and Mechanical Co.,

**MENOMINEE, MICH.**

---

## Gordon Primary Battery

EXCELS IN

Long Life, Efficiency,
Economy, Adaptability.
It is Absolutely Non Freezing,
Labor Saving,
Free from Local Action,
Freedom from Gases and Odors.
Superior Generation of Energy.

These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America.
Send for descriptive circular and price list.
We guarantee all our Cells.

MANUFACTURED BY

**The Gordon-Burnham Battery Co.,**
**82 West Broadway, New York.**

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## ALPHA ELECTRIC LAMP SIGNS....

## NEW ERA IN ELECTRIC ADVERTISING.

Each lamp is a single letter, which greatly simplifies the construction of a sign, and permits an unlimited advertising display. This sign is low-priced, economical of operation, easily read, very conspicuous, and may be changed in a moment from one form of words to another. We manufacture High Grade Incandescent Lamps. Lamps of any voltage furnished.

**Ask your NEAREST SUPPLY HOUSE for Sample or write**

## DICKINSON ELECTRIC SUPPLY CO.,

**High Grade Incandescent Lamps,**

American Tract Society Building, NO. 150 NASSAU STREET, NEW YORK.

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## "J.P." STYLES of TROLLEY HANGERS.

Strong and Light,
Highest Grade Workmanship and Material.

**Moulded Mica Insulation.** **Vulcabeston** Controller Parts, etc.

*SEND FOR REVISED PRICE LIST.*

No. 900

## H. W. JOHNS MFG. CO.,

**240-242 Randolph Street, CHICAGO.**

NEW YORK. PHILADELPHIA. BOSTON.

No. 905.

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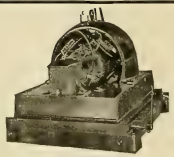
## CARD

Generators for Power Transmission or Isolated Lighting.
CARD Generators are all Multipolar and Slow Speed.

**AGENTS WANTED IN UNOCCUPIED TERRITORY.**



75 K. W. GENERATOR.

## CARD

Multipolar Slow Speed Stationary Motors.
Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

**THE CARD ELECTRIC COMPANY,**
**Office and Works, Mansfield, Ohio.**

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# BUCKEYE

## INCANDESCENT LAMPS

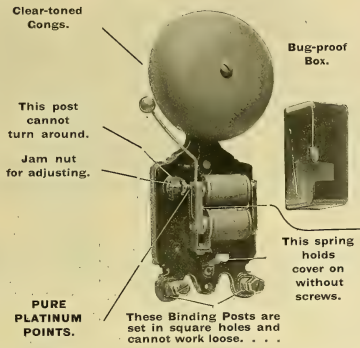
QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

Monadnock Building, Chicago. **THE BUCKEYE ELECTRIC CO., Cleveland, O.**

# THE EXTRA BEST BELL.

## "Extra B. B." Iron Box.




**TO THE CONTRACTOR** who puts up his hundreds of bells every year, or to the individual who wishes to fix an electric call for himself—we can offer nothing better than our **EXTRA B. B.** Iron Box Bell. Every part is carefully designed with the view of giving long service with an economical consumption of battery energy. . . . . On a short line, one cell of our **MESCO DRY BATTERY** will do perfect work. On lines of 200 feet and over, two cells should be used. **OBSERVE THAT this bell requires no tinkering.**

**Prompt Shipments** made for all House-fitting electric supplies. Battery supplies of every description. Plain and ornamental pushes. Annunciators, Burglar and Fire Alarms. . . . . .

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....CORRESPONDENCE SOLICITED....

GEO. A. McKINLOCK, President. CHAS. E. BROWN, Secretary.

## Central Electric Company

173-175 Adams Street

Chicago

DIAMOND IT NEVER DISAPPOINTS

INTERIOR CONDUIT.

St. Louis: Southern Electrical Supply Company.

New Orleans: 1010 Canal Street. Buffalo: 112 White Building.

Kansas City: Gate City Electric Co.

# WILLIAM H. BRYAN, M. E.,
# H. H. HUMPHREY, A. M., M. S.,

## Mechanical and Electrical Engineers.

**ANNOUNCEMENT.**—My work in Mechanical Engineering—particularly in Water Works, Boiler and Engine Trials, Steam Heating and Ventilation—has grown to such proportions as to make it necessary for me to secure additional expert assistance.

I have, therefore, entered into an arrangement with **Mr. H. H. Humphrey** to associate himself with me for the purpose of giving special attention to professional work in **ELECTRICAL ENGINEERING.**

**Mr. Humphrey** has been long and favorably known to the Electrical Fraternity, and his training, which has been wide and varied, both in theory and practice, eminently fits him for this work.

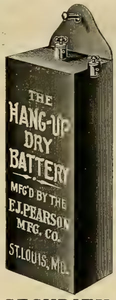
March 1, 1896. WM. H. BRYAN.

**Consultations, Examinations, Estimates, Tests, Reports, Plans, Specifications, Superintendence and Purchasing,**

—In connection with—

**Water Works—Municipal or Private Electric Lighting Installations. Electric Railway and Power Systems, Electric Power Transmission. Steam and Power Plants, Steam Heating, Smoke Abatement. Ice Making and Refrigeration.**

**Rooms H and I, Turner Building, - - ST. LOUIS.**




# See that Nail!
# You Hang 'Em Up.

**...NO SHELVES...**
**...NO BOXES......**

**THEY ARE**

Easy to install out of the way, can't tip over, causing endless trouble, and just what you have been looking for. Write for prices

**THAT BEAT THE WORLD.**

# The F. J. Pearson Mfg. Co.,

SECURITY BUILDING, - ST. LOUIS, MO.


# CLASSIFIED INDEX OF ADVERTISEMENTS.

**Accumulators.**
American Battery Co
Electric Storage Battery Co.
Hess Storage Battery Co.
Ohio Storage Battery Co.

**Annunciators.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
Mason, J. W.
Menominee El. & Mech. Co.
Partrick & Carter Co.

**Arc Lamps.**
Adams-Bagnall Elec. Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Fleming-Spence Elec. Co.
Ft. Wayne Elec. Corporation.
Hammer & Randolph.
Perkins Elec. Switch Mfg. Co.
Van Nuis, C. S.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Boynton Multivolt Batt'y Co.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
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Northwest Engineering Co.
Ohio Storage Battery Co.
Partrick & Carter Co
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Western Electric Co.

**Bells.**
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
National Electric Co.
Partrick & Carter Co
Washington Electric Co.
Western Electric Co.

**Belting.**
Channon Co., H.
Chicago Belting Co.
Jewell Belting Co.
Rhoads & Sons, J. E.
Shults Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Collins & Co., H. E.
Moyes, L. M.
Murray Iron Works Co.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor Bronze Sm. Co., Ltd.

**Brushes.**
Bernardin, F. M.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Crown Woven Wire Brush Co.
Holmes Fibre Graphite Co.
Mason, J. W.
Phila. Elec. & Mfg. Co.
Partridge Carbon Co.
S. K. C. Specialty Co.
Solar Carbon & Mfg. Co.
Wirt, Chas.
Younglove & Gere.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R.
Central Electric Co.
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F.
New York Ins. Wire Co.
Nat'l Underground Cable Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Carbons, Points & Plates.**
American Carbon Co.
Bernardin, F. M.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
General Electric Co.
Mason, J. W.
Partridge Carbon Co.
Reisinger, Hugo.
Schiff, Jordan & Co.
Solar Carbon & Mfg. Co.
Standard Paint Co.
Wertheim, Ed.
Western Electric Co.

**Cigar Lighters.**
National Electric Co.

**Compound.**
S. K. C. Specialty Co.
Standard Paint Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.

**Construction & Repairs.**
Bernardin, F. M.
Ft. Wayne Elec. Corporation.
Richards & Meacham.

**Contractors and Electric Light Plants.**
Arnold, B. J.
Bain, Foree.
Brush Electric Co
Bryan & Humphrey.
Card Electric Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Schott, W. H.
Siemens & Halske Elec. Co.
United Elec Improvement Co
Westinghouse Elec & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas H.
Bowers Bros.

**Copper Wires.**
American Electrical Works.
Bernardin, F. M.
Besly & Co., Chas. H.
Brixey, W. R.
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Chicago Edison Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Menominee El. & Mech. Co.
National India Rubber Co.
Okonite Co. The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Bernardin, F. M.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Mason, J. W.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bernardin, F. M.
Brodie Electric Co.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Protection Co.
Evanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Morrison Southern El. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
Phila. Elec. & Mfg. Co.
S. K. C. Specialty Co.
Washington Electric Co.
Westinghouse El. & Mfg. Co

**Dynamos.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Dallett & Co., Thos. H.
Eddy Elec. Mfg. Co.
Electrical Eng. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Siemens & Halske Elec. Co.
Toomey, Frank.
Walker Mfg. Co.
Westinghouse Elec. & Mfg. Co.

**Electric Railways.**
Brush Electric Co.
Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B J.
Bain, Foree.
Bryan & Humphrey.
Eddy Elec. Mfg. Co.
Schott, W. H.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bernardin, F. M.
Central Electric Co.
Chicago Edison Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co
Washington Electric Co.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Electrical Specialties.**
Brodie Electric Co.
Commercial Elec. Sup. Co
Electric Protection Co.
Menominee El. & Mech. Co.
Pearson, F. J. Mfg. Co.
Phila. Elec. & Mfg. Co.
S. K. C. Specialty Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.
Weber Gas & Gaso'l Eng. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Ball Engine Co.
Chuse & Co., J. F.
Murray Iron Works Co.
Racine Hardware Co.
Toomey, Frank.
Weston Engine Co.

**Engravers.**
Chic. Electro & Stereo Co.

**Exhaust Pipe Heads.**
Faucett, I. L.

**Fan Motor and Lamp Guards.**
Ingalls, Wm.

**Fan Outfits.**
Central Electric Co
Emerson Elec. Mfg. Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Westinghouse El. & Mfg. Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co.
Holmes Fibre-Graphite Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

**Files.**
Barnett Co., G. & H.

**Fire Alarms.**
Partrick & Carter Co
Western Electric Co.

**Forges.**
Union Heater Supply Co

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gaskets.**
Peerless Rubber Mfg. Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Berliner Telephone Co.
Bernardin, F M.
Besly & Co., Chas. H.
Brodie Electric Co.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Metropolitan Electric Co.
Morrison Southern El. Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.
Pearson, F. J. Mfg. Co.
Phila. Elec. & Mfg. Co.
Sioux City Brass Works.
S. K. C. Specialty Co.
Standard Tel. & Elec. Co.
Westinghouse El. & Mfg. Co

**Globe Nets.**
Ingalls, Wm.

**Globes and Electrical Glassware.**
Edgerton Pottery Co.
Phoenix Glass Co.

**Gov'nors, Water Wheel.**
Lombard Water Wheel Gv. Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Wks.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Beardsley Mfg. Co.
Bernardin, F. M.
Brixey, W. R.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Evanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Insulated Wires and Cables—Magnet Wire.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
Nat'l Underground Cable Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co
Dickinson Elec. Supply Co.
Eclipse Elec. Lamp Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Globe Electric Light Co.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
United Elec. Imp. Co.
Westinghouse Elec. & Mfg Co.

**Lightning Arresters.**
Electric Appliance Co
Garton-Daniels Electric Co.
General Electric Co
Westinghouse El. & Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Manhole Covers.**
Greger Manhole Cover Co.

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Ferracute Machine Co.
Murray Iron Works Co.

**Mica.**
Bowers Bros.
Electrical Eng. Co.
Johns Mfg. Co., H. W.
Munsell & Co. Eugene.
Schoonmaker, A. O.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg Co

**Motors.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Dallett & Co, Thos. H.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Menominee El. & Mech. Co.
Roth Bros. & Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Walker Mfg. Co.
Westinghouse El. & Mfg Co

**Oil Feeders.**
Dailey, Jas. W.

**Packing.**
Besly & Co., Chas. H.
Garlock Packing Co.
Peerless Rubber Mfg. Co.

**Paints.**
MacCurdy & Smith.
Standard Paint Co.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co Ltd

**Platinum.**
Baker & Co.

**Poles.**
Bernardin, F. M.
Central Mfg. Co.
DeWitt Brown Cedar Co.
Hart, C. S.
Lindsley Bros.
Morris, Tasker & Co.
Nuttall Co., R. D.
Perrizo, Paul, Jr. Co.

**Porcelain.**
Commercial Elec. Sup. Co
Empire China Works
General Electric Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.

**Rheostats.**
Central Electric Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Partrick & Carter Co.

**Speed Indicators.**
Besly & Co., Chas. H.
Weston Electrical Inst. Co
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Hess Storage Battery Co.
Ohio Storage Battery Co.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works
Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
Berliner Telephone Co.
Central Electric Co.
Clark Tel. & Cons. Co.
Commercial Elec Sup. Co.
Conn. Tel. & El. Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co
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Keystone Telephone Co.
Mason J. W.
Northwest Engineering Co.
Richards & Meacham.
Standard Tel. & Elec. Co.
Viaduct Mfg. Co.
Western Electric Co.

**Transformers.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Stanley Electric Mfg. Co
Westinghouse El. & Mfg. Co.

**Trolley Cord.**
Bernardin, F. M.
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stillwell-Bierce & Smith-Vaile Co.

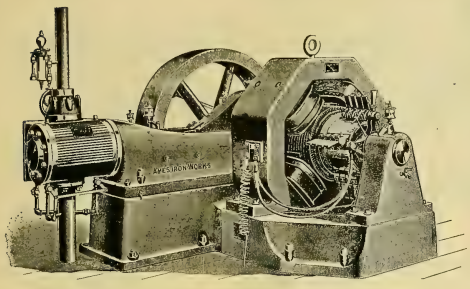
**Universities.**
Cor. School of Technology.
Int. Corr. Schools.

**Water Wheels.**
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
Bi-Metallic El. Trans. Co.
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Standard Underground C. Co

For Alphabetical Index of Advertisements See Page iii.

# Eddy Generators



DIRECT CONNECTED OR BELTED

FOR

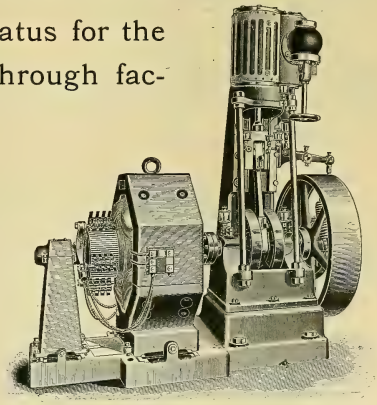
ELECTRIC RAILWAYS,
CENTRAL STATIONS,
ISOLATED LIGHTING,

OR

POWER PLANTS.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.



## All Our Apparatus Guaranteed As Represented.

## The Eddy Electric Manufacturing Company,

**WINDSOR, CONN.**

New York, H. B. Coho & Co., Mail and Express Building.
Philadelphia, Walter C. McIntire & Co., 506 Commerce St.
Boston, G. M. Angier & Co., 64 Federal St.
Elmira, S. N. Blake.
St. Louis, Western Electrical Supply Co.
Kansas City, W. T. Osborn.

**Western Office: 305 Dearborn St., Chicago, Wallace & Hine, Western Agents.**

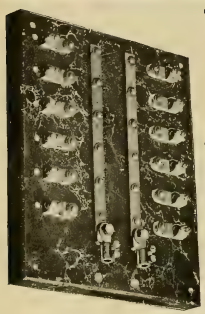
# GLOBE ELECTRIC LIGHT COMPANY,

....MANUFACTURERS OF....

## "GLOBE" INCANDESCENT LAMPS.

**ABSOLUTELY DRY VACUUM.**

**6 Clifton Street, Roxbury, - - Boston, Mass.**



## TABLET BOARDS, SWITCHES AND SWITCHBOARDS

of all descriptions.

WRITE FOR OUR NEW CATALOGUE D.

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Formerly J. Grant High & Co.,

123 N. 3d St., - - - Philadelphia, Pa.

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NEW YORK, 136 Liberty St., Chapin & Douglas.

LOUISVILLE, KY., No. 313 W. Main St., Jas. Clark, Jr., & Co.

NEW ORLEANS, LA., No. 608 Customhouse St., Widmer & Spranley.

## ELECTRICAL SUPPLIES,

## ELECTRICAL FIXTURES,

**A FULL LINE IN STOCK.**

## Chicago General Fixture Co.,

**169 ADAMS STREET,**

**CHICAGO, ILL.**

## DALLETT

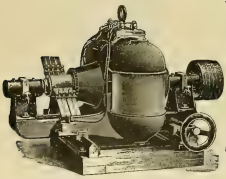
## Electric Motors and Generators,

MANUFACTURED BY

**THOS. H. DALLETT & CO.,**

York St. and Sedgley Ave.,

PHILADELPHIA, PA.



**Portable Electric Drills, Starting Boxes and Controllers,**

Automatic Switches.....

Flexible Insulated Couplings.

CHICAGO OFFICE, 107 E. MADISON STREET.

# The "Electra" Carbons.

**IMPORTED**

**HIGH GRADE NUERNBERG CARBONS**

ELECTRA TRADE MARK

ELECTRA TRADE MARK

**FOR DIRECT CURRENT ARC LAMPS.** **FOR ALTERNATING CURRENT ARC LAMPS.**

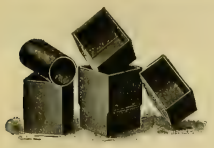
**Are by far the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light, burning without any dust.**

SEND FOR LATEST PRICE LIST TO

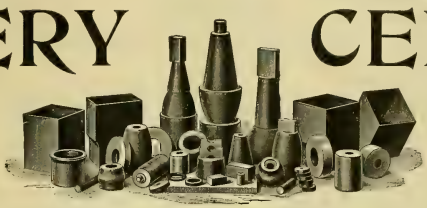
## HUGO REISINGER,

**NO. 38 BEAVER STREET, NEW YORK.**

Sole Importer for the United States and Canada.



# THE FREEMAN BATTERY CELLS.



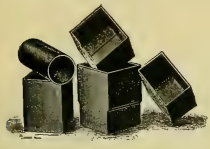
**ESTIMATES FURNISHED ON APPLICATION. PROMPT DELIVERY.**

**STANDARD SIZES ALWAYS ON HAND.**

The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished, providing additional strength to such an extent that this cell can be used where no other would be practical.

## THESE CELLS ARE A NEW PRODUCTION AND FULLY GUARANTEED.

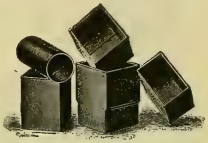
**AGENTS WANTED IN ALL CITIES.** **WRITE US FOR INFORMATION AND CATALOGUE.**



FOR PROMPT REPLY ADDRESS

J. Frank Dunbar, Treasurer, **NEWTON RUBBER CO.,**

87 SUMMER ST., BOSTON, MASS.



# The National Underground Cable Co.

**Times Building, New York. Rookery, Chicago. Betz Building, Philadelphia, Ames Building, Boston.**

This company is controlled by and is the associate of the National Conduit Manufacturing Company, and is manufacturing the well-known Norwich Paper Insulated Wires and Lead Sheathed Cables for all purposes; Electric Light, Street Railway, Telephone and Telegraph. All cables and wires guaranteed. High Potential Conductors a Specialty.

Write for further information to New York office.

The brilliant rays of the **UPTON ARC LAMP** are rapidly finding their way into every part of our broad land. Are they making your pathway any brighter? If not, cut this out—

# UPTON ARC LAMP

And paste it in your hat, and the next time you want arc lamps for either

SERIES, ALTERNATING OR DIRECT CURRENT

Write us about it. Catalogue and low prices on application.

## ELECTRIC APPLIANCE COMPANY,

ELECTRICAL SUPPLIES. 242 MADISON ST., CHICAGO.

—THE—

## PEERLESS SPIRAL Piston and Valve Rod PACKING

Expressly for High Speed Engines. Will Hold 400 lbs. Steam.

20 YEARS OLD AND NO EQUAL.

Manufactured Exclusively by

## PEERLESS RUBBER MFG. CO.

970 Old Colony Bldg., Chicago, Ill.
16 Warren Street, New York.

½ to 2 inch diameter. In Boxes 3 to 8 lbs.

# PERFECT INSULATION

Can only be Secured by the use of . . . **P** and **B** Compound, Varnish, Tape, Paper.

## Are You Acquainted With Them?

IF NOT, WRITE FOR PARTICULARS TO

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METROPOLITAN ELECTRIC CO., 186-188 Fifth Ave., . . . CHICAGO.

WILLIAM INCLIS,

## Wire Specialties.

Send Samples for Prices.

95 Shelby Street, - DETROIT, MICH.

The Best on the market.

MacCurdy & SMITH, Indianapolis, Ind.

OUR ALTERNATING

## Current Ammeters

....AND....

## VOLTMETERS

FOR SWITCH-BOARD WORK

are superior to anything on the market, and our prices—well, write to us and we will tell you all about them.

Whitney Electrical Instrument Co., PENACOOK, N. H., U. S. A.

# CHICAGO INSULATED WIRE CO.,

153 LAKE STREET, - CHICAGO.

# IF YOU WANT

A first-class COMMUTATOR use Solid Sheet Mica Insulation with B. & S. Drop-forged Segments.

## BOWERS BROTHERS, 117-119 Lake St., Chicago.

Agents wanted in leading cities. Samples sent on approval to responsible parties

YOUNGLOVE & GERE, Syracuse, N. Y.

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FOR ELECTRICAL USES:

Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.

JOS. DIXON CRUCIBLE CO., Jersey City, N. J.

I-T-E Automatic Magnetic

# CIRCUIT-BREAKERS,

C. S. Flush Switches.

The Cutter Electrical & Mfg. Co., 1112 Sansom St., Philadelphia.

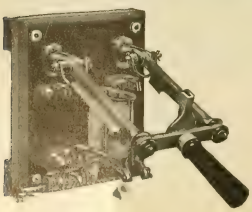
SEND FOR SAMPLES AND PRICES OF

## SAMSON SPOT CORD

For Arc Light and Trolley Cord.

SAMSON CORDAGE WORKS, - BOSTON, MASS.

# MOTOR ARMATURES COST MONEY



You can prevent them from burning out by using

## THE BRODIE AUTOMATIC MOTOR-SWITCH.

It combines in one piece of apparatus a double-pole switch, adjustable limit-switch and automatic cut-out, and instantly disconnects the motor whenever it is overloaded and whenever the circuit fails from any cause. Each switch is adjustable for motors of widely different horse-power.

For circulars and prices, address

## THE BRODIE ELECTRIC CO., - Manchester, N. H.

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy.

# AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

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MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

# SAL AMMONIAC.

(ELECTRIC BRAND.)

## FOR ELECTRICAL PURPOSES.

Guaranteed 98/99 per cent. and free of lead and iron.
If you want the best quality ask your dealer for this brand. Imported by

A. KLIPSTEIN & COMPANY, 122 Pearl St., New York.

THE

# "CLARK" WIRE.

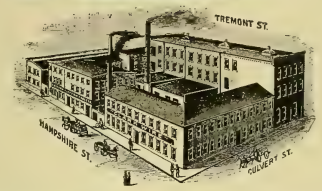
For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

BRANCH OFFICE:

1649, 1650, 1651 MONADNOCK BLDG.,
CHICAGO, ILLINOIS.

TRADE MARK.




In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

EASTERN ELECTRIC CABLE CO.,

61 and 63 Hampshire St., Boston, Mass.

HENRY A. CLARK, Treas. and Gen'l Mgr. HERBERT H. EUSTIS, Pres. and Electrician.

## Are you alive to your own interest?

If so, better use our Arc Cut-Outs, Carbon Holders, Machine Brushes, Segments, Etc. Write us for prices on anything you are in need of, as we manufacture arc lighting supplies in general.

The Phila. Electrical & Mfg. Co.,
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SALES AGENTS:
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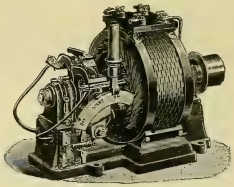
Western Electrical Supply Co., 10 and 12 N. 9th St., St. Louis, Mo.

## SINGLE PHASE A. C. POWER MOTORS.

16,000 Alts., ½—¾—1 H. P.
7,200 " ½—¾—1—1½ H. P.

Efficient,
Non-Synchronous,
Start with
50 per cent.
Overload.



Durable,
Fully
Guaranteed,
Handsome.

PAT'D FEB. 14, 1893; SEPT. 18, 1894, AND PATENTS PENDING.

THE EMERSON ELECTRIC MFG. CO.,
Write for Prices. ST. LOUIS U. S. A.

# MICANITE THE STANDARD INSULATION.

IT IS A FACT that more than three-quarters of the manufacturers of Electrical machinery for light and power transmission use MICANITE as the insulation in the construction of their various designs of apparatus.
Write for estimates on special forms of Insulation, Commutator, Rings, Segments and Armature Insulation.

Micanite and Empire Cloth and Paper for insulating armature cores and fields.

MICA INSULATOR CO., Sole Mfrs.,
General Office, 218 Water St., New York.

FACTORIES: { Schenectady, N. Y. / London, England.

# ELECTRICAL SUPPLIES.

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CHICAGO. NEW YORK.

AGENCIES:
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PETTINGELL-ANDREWS CO., BOSTON, MASS.
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# Phillips Insulated Wire Co.,

NEW YORK OFFICE: 39 and 41 Cortlandt St.
FACTORY: Pawtucket, R. I.

**WANTED.**

**An Excellent Opportunity for a Young Man!**

The advertiser controls valuable electric heating patents(sad irons, soldering outfits, etc.),and wants a young man, electrically educated and with some capital, to join him in pushing the electrical heating business already organized and established and with good orders on hand. A salary would be paid and young man and advertiser (business man) can control this business. Address **"Heater,"** care WESTERN ELECTRICIAN.

## SALESMAN WANTED.

One who is now selling the electric trade in the West and Southwest, and would be willing to take up an article used by all electric roads and manufacturers, on commission. Address,

X. Y. Z., care WESTERN ELECTRICIAN.

## WANTED,

Salesmen to sell Mica and other Insulation on commission; side line.

**W. H. SILLS & CO.,**
**153 Lake St., Chicago, Ill.**

## Situation Wanted

By a man who has the formula for making the best china for electrical purposes in the market, glazed or unglazed; also understands making all kinds of window and wall tubes of all lengths and sizes, curved tubes, etc., and all kinds of press work. Address, **"A. K. N."** care

WESTERN ELECTRICIAN, Chicago.

## $5,000.00

Will purchase one-third interest in a large and successful Electrical Supply and Construction Company located in the West; 20 per cent. per annum profits guaranteed upon investment. If you are a bookkeeper or an experienced electrician, position also at not less than $100 per month. Address

**Electrical Construction,**
Care of WESTERN ELECTRICIAN,
**CHICAGO, ILL.**

## FOR SALE.

50-light "Standard" arc machine, with lamps. Can be seen running. Is in splendid working order, and nearly new. Would exchange for a new eight-hundred-light incandescent machine. Address **Lapp & Flershem,** 96 State St., Chicago, Ill.

**Bargains in Machinery for Street Railways.**

One 600 h. p. Corliss engine, one 300 h. p. Corliss engine; one 300 h. p. Westinghouse compound engine; one 250 h. p. Ball automatic engine; two 125 h. p. Ball automatic engines; two 80 h. p. Ball automatic engines; two 125 h. p. generators, 500 volts; four 60 h. p. generators, 500 volts; large stock of automatic engines and dynamos of every description. Also a battery of compound boilers, 700 h. p., 160 h. p. in a pair. FRANK TOOMEY, 131 N. Third Street, Philadelphia.

## FOR SALE.

20 horse power Horizontal Tubular Steam Boiler; been used but a few months. 12 horse power Steam Engine. Both in first-class condition.

**L. A. HINE,**
**234 East Lake St., Chicago.**

## FOR SALE,

**A Modern Electric Light and Power Plant,**

Consisting of six 100 H. P. McCormack Cylinder Gate Water Wheels, set in six stone flumes, all in gilt-edged shape, with best of shafting, foundations, brick building, etc., all new. Two Russell Automatic Engines of 450 H. P. capacity, for use in case of emergencies. One 60 H. P. power generator, three alternating dynamos of 3,500 light capacity and seven arc dynamos of 300 light capacity. A five-year city street lighting contract, 100 lights, also several commercial patronage. Excellent water power lease for thirty years at $40 per H. P. per year.

A snap for the right man; owners going away. Will bear closest investigation.

Location is a prosperous manufacturing Indiana town of 15,000 people.

Address the owner

**O. N. LUMBERT,**
SYRACUSE, N. Y.

**...PROPOSALS TO...**

## Electric Light Contractors and Investors.

CITY OF MADISON, INDIANA.

## NOTICE

Is hereby given that sealed proposals will be received by George B. Clark, City Clerk of said City, up to Wednesday, April 8, 1896, at 7 o'clock p. m., for the furnishing and constructing of a new Electric Light Plant. The successful contractor to receive from said city a contract for lighting the streets for a term of ten years with one hundred to one hundred and twenty-five arc lamps, 2,000 candle power, all night schedule, every night. Said city to grant to the successful contractor a franchise for commercial lighting of said city for a term of ten years.

The said contractor to build, construct, equip and operate approximately three miles of electric street railway and receive from said City of Madison a franchise therefor of thirty years.

All work to be done and contracts entered into according to the plans and specifications now on file in the City Clerk's office, or at the office of Messrs. Pierce & Richardson, No. 1405-1410 Manhattan building, Chicago, Ill., consulting engineers for the City of Madison.

Copies of plans and specifications may be had on application to either of the above parties.

**GEORGE B. CLARK,**
City Clerk.

## WANTED!

The address of every man who is desirous of improving his position or broadening his knowledge of Electricity, and is willing to devote a little time and energy to do so. Address,

**Dept. I, Electric Development Association,**
**CHICAGO.**

## Position Wanted

By young man experienced in setting up dynamos and motors. Expert armature winder and repair hand. Good at figures, rewinding for any voltage. Position with construction company preferred, or will take charge of station. Best of references. Address, **"RELIABLE."**
Care WESTERN ELECTRICIAN.

## $600! $600!

## FOR SALE

**New 50 Light Arc Dynamo,**

Complete with the usual accessories and full guaranty of manufacturers. Have no use for it and will be sold for six hundred dollars cash.

Address ARC MACHINE,

WESTERN ELECTRICIAN Office.

## ROTH BROS. & CO.,

**30-34 Market Street, CHICAGO,**

Manufacturers of

**Fan Motors, Dynamos** AND **Electric Motors.**

Send for catalogue.

## Stilwell's Patent LIVE STEAM-FEED Water Purifier.

**Removes all Impurities.**

ENTIRELY PREVENTS SCALE IN STEAM BOILERS. Catalogue on Application.

The Stilwell-Bierce & Smith-Vaile Co.,
**DAYTON, OHIO.**

**Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agent.**

**C. S. HART,**
WHOLESALE
**Telegraph, Telephone, Electric Light AND STREET RAILWAY POLES.**
Manufactured from Live Cedar peeled. Quick shipments and best quality.
**OCONTO, WIS.**

## INDIA AND AMBER MICA.

**Can furnish any Size, shape or pattern. Write for samples and quotations.**

**A. O. SCHOONMAKER,** Importer,
**158 William St., New York.**

## POLES (CEDAR.) TIES.

Telephone, Electric Light and Street Railway Poles. Telephone Poles a Specialty.

Write for delivered prices. **LINDSLEY BROS., MENOMINEE, MICH.**

Write PAUL PERRIZO JR. CEDAR & LUMBER COMPANY, Marinette, Wis. - for prices on

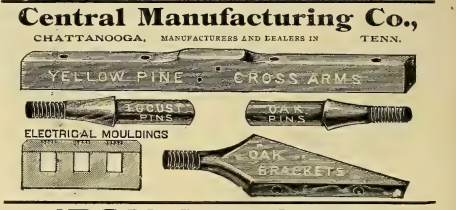
## WHITE CEDAR POLES

before purchasing elsewhere.

**MENOMINEE, MICH., for prices on WHITE CEDAR POLES.**

## Central Manufacturing Co.,

CHATTANOOGA, MANUFACTURERS AND DEALERS IN TENN.




## IRON ARMORED INSULATING CONDUITS.

Two Wires in a Single Tube, the Standard Method of Electric Wiring.

## INTERIOR CONDUIT & INSULATION CO.,

**General Offices and Works: 527 W. 34th St., New York.**

## A PERFECT MANHOLE COVER.

**Not Expensive.**
**Horses cannot slip on it.**
**Streets can have an even surface.**

SEE WHAT IS IN OUR FAVOR

**A "Creger" Cover Covers a Surface 4 ft. 6 in. x 5 ft. Old Style Cover Covering Surface 2 ft. 8 in. x 4 ft. 2 in.**

**CAN BE USED ON OLD MANHOLE FRAME.**

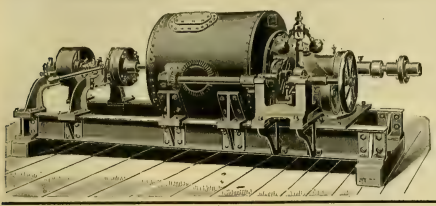
LIBERAL ARRANGEMENTS for Parties to Manufacture in all Leading Cities.

WRITE FOR PARTICULARS.

**The Creger Manhole Cover Co.,**
**1104 Betz Bldg., - - - PHILADELPHIA, PA.**

# Victor Turbine Water Wheel.

**Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.**



The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double the power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

*SEND FOR CATALOGUE AND PARTICULARS.*

The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 20 H. P. under 35 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts, and where the situation admits of their use we recommend them.

**THE STILWELL-BIERCE & SMITH-VAILE CO., DAYTON, OHIO.**

Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agents.

*The Standard Open Circuit Batteries of the World.*

SEND FOR CIRCULAR AND PRICES.

**THE LECLANCHE BATTERY CO.,**

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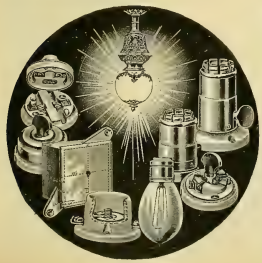

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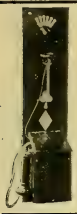

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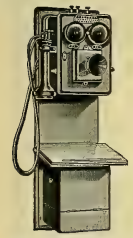

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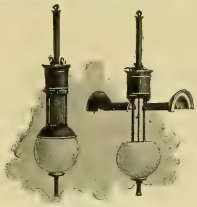

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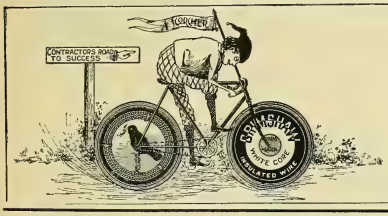

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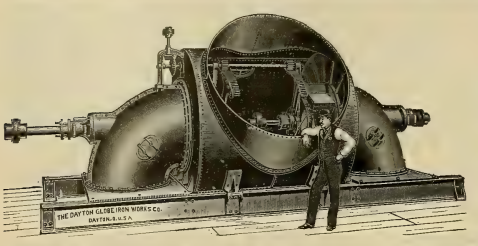


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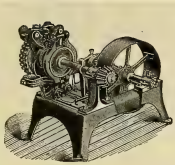

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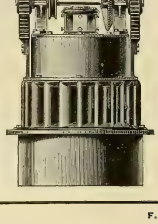

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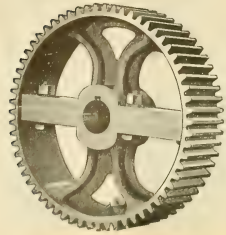

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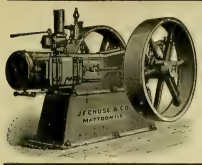

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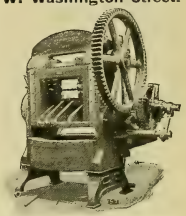

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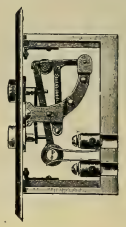

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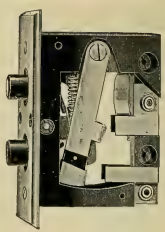

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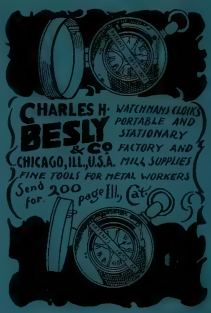

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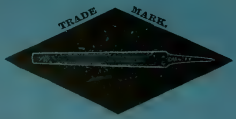


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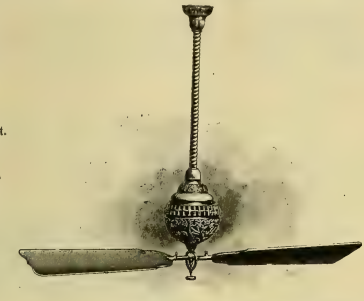

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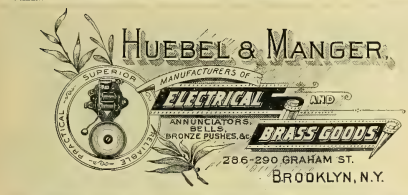


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# HARDTMUTH CARBONS,

**Cored and Solid for Direct Lighting.**

## ...LARGE IMPORTATION JUST ARRIVED...

General Western Agents:

## Chicago Edison Company,

**..DEALERS IN ELECTRIC LIGHTING SUPPLIES..**

**Edison Building, 139 Adams Street, CHICAGO, ILL.**

---

## *JUST NOW*

Is the time to decide on the Fan Motor you intend to handle this season. Our direct current motor is equal to the best, if its intrinsic merit is considered.

---

## Annunciators, Medical Farradic Batteries.

MAGNETO, HAND AND POWER

**...GENERATORS...**

**INDUCTION AND SPARK COILS, ETC., ETC.**

**WRITE FOR CATALOGUE**

## Menominee Electrical and Mechanical Co.,

**MENOMINEE, MICH.**

---

## ALPHA ELECTRIC LAMP SIGNS....

## NEW ERA IN ELECTRIC ADVERTISING.

Each lamp is a single letter, which greatly simplifies the construction of a sign, and permits an unlimited advertising display. This sign is low-priced, economical of operation, easily read, very conspicuous, and may be changed in a moment from one form of words to another. We manufacture High Grade Incandescent Lamps. Lamps of any voltage furnished.

**Ask your NEAREST SUPPLY HOUSE for Sample or write**

## DICKINSON ELECTRIC SUPPLY CO.,

**High Grade Incandescent Lamps,**

American Tract Society Building, NO. 150 NASSAU STREET, NEW YORK.

---

## Gordon Primary Battery

EXCELS IN

Long Life, Efficiency,
Economy, Adaptability.
It is Absolutely Non Freezing,
Labor Saving,
Free from Local Action,
Freedom from Gases and Odors.
Superior Generation of Energy.

These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America. Send for descriptive circular and price list. We guarantee all our Cells.

MANUFACTURED BY

**The Gordon-Burnham Battery Co.,**

**82 West Broadway, New York.**

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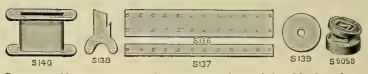
## VULCABESTON CONTROLLER PARTS.




## All Controllers are Insulated with Vulcabeston.

**G. E. 800 and Westinghouse Commutator Rings, Brush Holder Bushings and Field Spools.**

**SEND FOR PRICE LIST.**

Moulded Mica Trolley Insulating Materials, Frogs, Crossings, Tree Insulators, Weatherproof Sockets, etc.

**H. W. JOHNS MFG. CO.,**

**240-242 Randolph St., Chicago, Ill.**

Gen. Elec. Co. NEW YORK. PHILADELPHIA. BOSTON. Westinghouse.

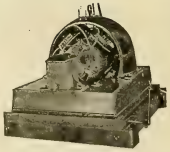
---

## CARD

Generators for Power Transmission or Isolated Lighting.

CARD Generators are all Multipolar and Slow Speed.

**AGENTS WANTED IN UNOCCUPIED TERRITORY.**



75 K W GENERATOR.

## CARD

Multipolar Slow Speed Stationary Motors.

Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

**THE CARD ELECTRIC COMPANY,**

**Office and Works, Mansfield, Ohio.**

---

## MICA, INDIA AND AMBER.

In the sheet and cut to any size or pattern. Mica Washers, Stamped Mica Segments and solid sheet Mica Segments gauged to thickness, for all the standard street railway motors.

**EUGENE MUNSELL & CO.,** Importers Direct from the Mines, 218 Water Street, New York.

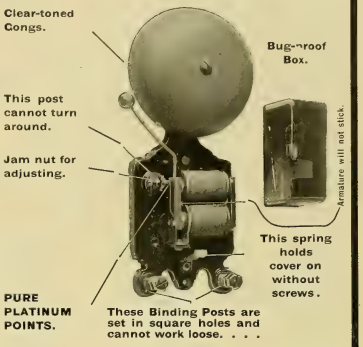
AGENCIES: CHICAGO: W. H. Sills. CINCINNATI: Sinclair Randall. ST. LOUIS: A. S. Partridge. CLEVELAND: The Cuyahoga Supply Co. SAN FRANCISCO: J. W. Brooks & Co.

## Made on the □

# The Extra Best Bell (Extra B. B.)

Let us run down the list of good things that can be said of the **"Extra B. B."**

1. It is well made mechanically.
2. Pure platinum contacts. Honor bright!
3. Binding posts set in a square hole, **tight.**
4. Contact post fixed same way. Can't get nervous and point in the wrong direction.
5. When you adjust the bell to suit your battery it stays there.
6. Armature will not stick.
7. Gets full benefit of both pole pieces.
8. Clapper will not drop off.
9. Cover snaps on. No screw to lose.
10. One dollar will buy more of these bells than any other **equally as good.**

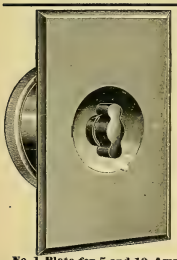



BRANCHES:
ST. LOUIS: Southern Electrical Supply Co.
KANSAS CITY: Gate City Electric Co.
NEW ORLEANS: 1010 Canal Street.
BUFFALO: 112 White Building.

## Central Electric Company,

CENTRAL STATION AND ELECTRIC RAILWAY SUPPLIES,

CHICAGO.



No. 1 Plate for 5 and 10 Amp. Hart Switches.

# HART FLUSH SWITCHES.

New Face Plate.

## BETTER PROPORTIONS. BETTER FINISH. MORE DURABLE.

Made of solid plate brass $\frac{1}{8}$-inch thick, with beveled edges.

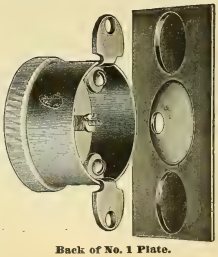
Better Design,
Better Material,

Self-Adjusting Handle,
No Breaking,

No Binding on Face Plates,
No Loose Face Plates.
Handles, Switches and Face Plates Interchangeable.

Single Plates for all sizes of Hart Switches.
Gang Plates for any number of Hart Switches.

**SEND FOR "CATALOGUE B."**



Back of No. 1 Plate.

## THE HART & HEGEMAN MFG. CO., HARTFORD, CONN.

# THE HESS DOUBLE ELECTRODE STORAGE BATTERY

**Is practically indestructible.**
**Its estimated life is unlimited.**
**Disintegration is entirely out of the question.**
**Buckling is absolutely prevented, not by resistant force but by a scientific new process.**
**THE HESS STORAGE BATTERY CO., of Philadelphia, who own and control the Hess patents, offer their system at cost of manufacture, estimated to be about one-third the price asked by manufacturers.**

**We organize State Companies to manufacture and install electric lighting plants, with gas engine, dynamo and storage battery.**

**Territorial rights granted. Patents in all countries.**

**The first successful Non-infringing Storage Battery ever produced in the United States. Note the contrast from the Supreme Court decision:**

"The distinguishing feature of the invention of Charles F. Brush in secondary batteries as described in the specification of Letters Patent of the U. S., No. 337,299, dated March 2, 1886, and issued to him for improvements in secondary batteries for the current storing of electrical energy, is in general terms the mechanical application of a layer of lead oxide to each one of two lead plates before the plates are placed in the battery fluid. These coatings at once being active material and ready for the charging current when immersed in the battery fluid." (Quoted from the syllabus of the case of the Electrical Accumulator Co. vs. Brush Electric Co., decided in the U. S. Circuit Court of Appeals for the Second Circuit, October 4, 1892.)

**In our battery the active material is fed to the plates after the plates are immersed in the battery fluid.**

**An authentic, reliable, unbiased test and report was made by Messrs. Houston & Kennelly, E. E., of Philadelphia, 97$\frac{135}{1000}$ per cent. ampere efficiency, 81 per cent. watt efficiency.**

**We prosecute and defend all patent law-suits.**
**We want representative parties to manufacture and install our batteries in every State.**
**Send for descriptive matter.**

## THE HESS STORAGE BATTERY CO., 246 ARCH STREET, PHILADELPHIA, PA.


# CLASSIFIED INDEX OF ADVERTISEMENTS.


**Accumulators.**
American Battery Co.
Electric Storage Battery Co.
Hess Storage Battery Co.
Ohio Storage Battery Co.

**Annunciators.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Electric Appliance Co.
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Menominee El. & Mech. Co.
Partrick & Carter Co.

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Adams-Bagnall Elec. Co.
Central Electric Co.
Chicago Gen'l Fixture Co.
Fleming-Spence Elec. Co.
Ft. Wayne Elec. Corporation.
Hammer & Randolph.
Perkins Elec. Switch Mfg. Co.
Van Nuis, C. S.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Batteries and Jars.**
Boynton Multivolt Batt'y Co.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Edgerton Pottery Co.
Electric Appliance Co.
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Northwest Engineering Co.
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Partrick & Carter Co.
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Western Electric Co.

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Central Electric Co.
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Huebel & Manger.
Menominee El. & Mech. Co.
National Electric Co.
Partrick & Carter Co.
Western Electric Co.

**Belting.**
Channon Co., H.
Chicago Belting Co.
Jewell Belting Co.
Rhoads & Sons, J. E.
Shultz Belting Co.

**Boilers.**
Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Collins & Co., H. E.
Moyes, L. M.
Murray Iron Works Co.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor BronzeSm.Co.,Ltd.

**Brushes.**
Bernardin, F. M.
Boudreaux Dyn. Brush Co.
Central Electric Co.
Crown Woven Wire BrushCo.
Holmes Fibre-Graphite Co.
Mason, J. W
Phila. Elec. & Mfg. Co.
Partridge Carbon Co.
Solar Carbon & Mfg. Co.
Wirt, Chas.
Younglove & Gere.

**Burglar Alarms.**
Central Electric Co.
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
Partrick & Carter Co.
Western Electric Co

**Cables** (See Insulated Wires.)
**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works
Brixey, W. R
Central Electric Co
Eastern Electric Cable Co
Elec. Engr. & Supply Co
Moore, Alfred F
New York Ins. Wire Co.
Nat'l Underground Cable Co.
Simplex Electrical Co.
Standard Underground C Co.
Western Electric Co.

**Carbons, Points & Plates.**
American Carbon Co.
Bernardin, F. M.
Central Electric Co.
Chicago Edison Co.
Chicago General Fixture Co.
General Electric Co.
Mason, J. W.
Partridge Carbon Co.
Reisinger, Hugo.
Schiff, Jordan & Co.
Solar Carbon & Mfg. Co.
Standard Paint Co.
Wertheim, Ed.
Western Electric Co.

**Cigar Lighters.**
National Electric Co.

**Compound.**
Standard Paint Co.

**Conduits.**
Central Electric Co.
Interior Conduit & Ins. Co.

**Construction & Repairs.**
Bernardin, F. M.
Ft. Wayne Elec. Corporation.
Richards & Meacham.

**Contractors and Electric Light Plants.**
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan & Humphrey.
Card Electric Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Schott, W. H.
Siemens & Halske Elec. Co.
United Elec Improvement Co.
Westinghouse Elec & Mfg Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas H.
Bowers Bros.

**Copper Wires.**
American Electrical Works.
Bernardin, F. M.
Besly & Co., Chas H.
Brixey, W. R.
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Chicago Edison Co
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Menominee El. & Mech. Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Bernardin, F. M.
Brady, T. H.
Central Electric Co.
Central Mfg. Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co , The.
Mason, J. W.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Bernardin, F. M.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec Engr. & Supply Co.
Electric Protection Co.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co , The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Elec. Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Morrison Southern El. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins Elec. Switch Mfg Co.
Phil. Elec. & Mfg. Co.
Utica El. Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

**Dynamos.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn Elec. Mfg. Co.
Dallett & Co., Thos. H.
Eddy Elec. Mfg. Co.
Electrical Eng. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Siemens & Halske Elec. Co.
Toomey, Frank.
Walker Mfg. Co.
Westinghouse El. & Mfg. Co.

**Economizers, Fuel.**
Fuel Economizer Co.

**Electric Railways.**
Brush Electric Co.
Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryant & Humphrey.
Eddy Elec. Mfg. Co.
Schott, W. H.

**Electrical Instruments.**
Anderson, Albert & J. M.
Bernardin, F. M.
Central Electric Co.
Chicago Edison Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Weston Electrical Inst. Co.
Whitney Elec. Inst Co.

**Electrical Specialties.**
Commercial Elec. Sup. Co.
Electric Protection Co.
Menominee El. & Mech. Co.
Pearson, F. J. Mfg. Co.
Phila. Elec. & Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Otto Gas Engine Wks.
Weber Gas & Gaso'l Eng. Co.

**Engines, Steam.**
Ball & Wood Co., The.
Ball Engine Co.
Murray Iron Works Co.
Racine Hardware Co.
Toomey, Frank.
Weston Engine Co.

**Engravers.**
Chic. Electro & Stereo Co.

**Exhaust Pipe Heads.**
Faucett, I. L.

**Fan Motor and Lamp Guards.**
Inglis, Wm.

**Fan Outfits.**
Central Electric Co.
Emerson Elec. Mfg. Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Tuerk Water Meter Co.
Westinghouse El. & Mfg. Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Butler Hard Rubber Co
Holmes Fibre-Graphite Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

**Files.**
Barnett Co., G. & H.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Forges.**
Union Heater Supply Co.

**Fuse Wire.**
Brixey, W. R.
Central Electric Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.

**Gaskets.**
Peerless Rubber Mfg. Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Berliner Telephone Co.
Bernardin, F. M.
Besly & Co., Chas. H.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Electric Protection Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Metropolitan Electric Co.
Morrison Southern El. Co.
National Electric Co.
Northwest Engineering Co.
Ohio Electric Works.
Partrick & Carter Co.
Pearson, F. J. Mfg. Co.
Phila. Elec. & Mfg. Co.
Sioux City Brass Works.
Standard Tel. & Elec. Co.
Utica El Mfg & Sup. Co.
Westinghouse El. & Mfg. Co.

**Globe Nets.**
Inglis, Wm.

**Globes and Electrical Glassware.**
Chicago Gen'l Fixture Co.
Edgerton Pottery Co.
Phoenix Glass Co.

**Gov'nors, Water Wheel.**
Lombard Water Wheel Gv.Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.
Newton Rubber Works.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Beardsley Mfg. Co.
Bernardin, F. M.
Brixey, W. R.
Butler Hard Rubber Co.
Central Electric Co.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
Newton Rubber Wks.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.
Utica El. Mfg. & Sup. Co.

**Insulated Wires and Cables—Magnet Wires.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
Nat'l Underground Cable Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
Eclipse Elec. Lamp Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
United Elec. Imp. Co.
Westinghouse El. & Mfg. Co.

**Lightning Arresters.**
Electric Appliance Co.
Garton-Daniels Electric Co.
General Electric Co.
Utica El. Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Manhole Covers.**
Greger Manhole Cover Co.

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Ferracute Machine Co.
Murray Iron Works Co.

**Mica.**
Bowers Bros.
Electrical Eng. Co.
Johns Mfg. Co., H. W
Munsell & Co., Eugene.
Schoonmaker, A. O.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Dallett & Co., Thos. H.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Menominee El. & Mech. Co.
Roth Bros. & Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Walker Mfg. Co.
Westinghouse El. & Mfg. Co.

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Garlock Packing Co.
Peerless Rubber Mfg. Co.

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Standard Paint Co.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd.

**Platinum.**
Baker & Co.

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Brown, DeWitt, Cedar Co.
Central Mfg. Co.
Hart, C. S
Lindsley Bros.
Morris, Tasker & Co.
Nuttall Co., R. D.
Perrizo, Paul, Jr. Co.

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Empire China Works.
General Electric Co.

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Electrician Publishing Co.

**Push Buttons.**
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Electric Appliance Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.

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General Electric Co.
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Electric Appliance Co.
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Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

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Barnes, Wallace.

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Webster & Co., Warren.

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Electric Storage Battery Co.
Hess Storage Battery Co.
Ohio Storage Battery Co.

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Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

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Clark Tel. & Const. Co.
Commercial Elec. Sup. Co.
Conn. Tel. & El. Co.
De Veau & Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co.
Gustafson, W. A.
Keystone Telephone Co.
Mason, J. W.
Northwest Engineering Co.
Richards & Meacham.
Standard Tel. & Elec. Co.
Viaduct Mfg. Co.
Western Elec. Co.

**Transformers.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.

**Trolley Cord.**
Bernardin, F. M.
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stilwell-Bierce & Smith Vaile Co

**Universities.**
Cor. School of Technology.
Int. Corr. Schools.

**Water Wheels.**
Leffel & Co , Jas.
Replogle Governor Wks.
Smith S Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas H.
Bi-Metallic El. Trans. Co.
Brixey, W. R
Central Electric Co
Electric Appliance Co
Independent Electric Co
National India Rubber Co.
Nuttall Co , R D.
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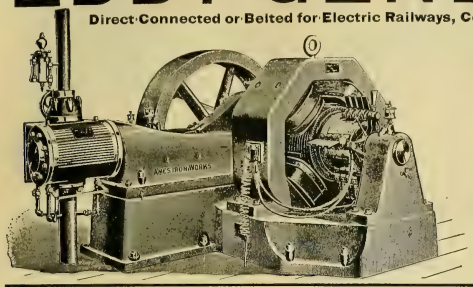
**For Alphabetical Index of Advertisements See Page III.**

# EDDY GENERATORS.

**Direct-Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.**



**Eddy Motors—Slow, Medium or High Speed.**

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

## The Eddy Electric Mfg. Co.,

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BOSTON, G. M. Angier & Co., 64 Federal St.
ELMIRA, S. N. Blake.
ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.
CINCINNATI, O., Nevada Bldg., John A. Stewart.
CHICAGO, 305 Dearborn St., Wallace & Hine, Managers.

# BI-METALLIC WIRE.

**(Manufactured by John A. Roebling's Sons Co.)**

**Copper and Steel. Copper for Conductivity, Steel for Strength. The two combined for the "bi-metallic" effect. A Superior Conductor.**

**Telephone, Telegraph, Trolley, Electric Light and Power.**

**PRICES AND GENERAL INFORMATION UPON APPLICATION TO**

## Bi-Metallic Electric Transmission Co.,

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# The S. K. C. Two Phase Alternating Current System.

**THE FIRST AND ONLY COMPLETE AND PERFECTED SYSTEM BY WHICH LIGHT AND POWER CAN BE SUPPLIED FROM THE SAME GENERATOR AND CIRCUITS. POWER TRANSMISSION AND DISTRIBUTION MADE PRACTICAL AND COMMERCIALLY SUCCESSFUL.**

## POINTS OF SUPERIORITY.

Our system is much more simple and consequently more durable than any other, either direct or alternating.

Our generator is much more efficient than any other alternator, requires less attention and absolutely no supplies except lubricant for bearings.

It is practically self-regulating without the loss of energy involved by compounding or compensating. Other multiphase machines require a balance of load.

We have entirely eliminated from our generators the usual sources of trouble, expense and interruption of service: i. e., the revolving armature, commutator, collector rings, brushes, etc.

They can be built for any voltage from 110 for isolated lighting to the high voltages required for power transmission work; in latter case doing away with the expense and loss of step-up transformers; the usual central station machine can be connected at will for either 1,000 or 2,000 volts.

The motors excel in simplicity of construction; in starting torque and simplicity of starting device; in efficiency in the manner in which they take current in proportion to their load, and in uniformity of speed under different conditions of load.

Our transformers insure satisfactory service and the greatest economy. We are prepared to fill all orders promptly, and carry a full stock of transformers in Chicago.

**Patents**—**Our apparatus is novel; different from anything heretofore made, and covered by patents that fully protect us and our customers. We are not infringing patents belonging to others, and shall avail ourselves of the patents under which we operate to protect ourselves from piracy by other manufacturers.**

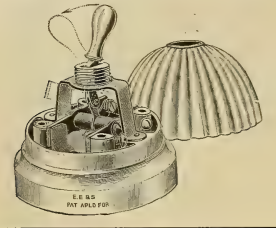
## STANLEY ELECTRIC MANUFACTURING CO.,

PITTSFIELD, MASS.

**WESTERN OFFICE, 305 DEARBORN STREET, CHICAGO, ILL.**

**The Royal Electric Co., Montreal, Can., are exclusive licensees for the manufacture of the S. K. C. System in the Dominion of Canada.**

# E. E. & S. CANOPY SWITCH.



This Switch is in all respects **A KNIFE SWITCH** placed **UNDER** a **COVER.** The break is quick and positive, entirely out of the control of the hand. Contacts and blades are made of pure copper. Easily wired and well proportioned.

Send us your orders and they will be promptly filled.

## Electric Engineering & Supply Co.,

**SYRACUSE, N. Y.**

## Switches and Switchboards

**Of all Descriptions.**

Write for our new catalogue "D."

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**Formerly J. Grant High & Co.,**

**123 N. 3rd STREET, PHILADELPHIA, PA.**

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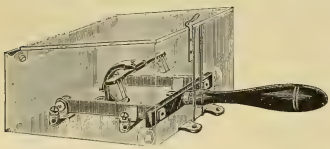
NEW YORK: 192 Liberty St., Chapin & Douglas.
LOUISVILLE, KY.: 313 W. Main St., James Clark, Jr. & Co.
NEW ORLEANS, LA.: 908 Custom House Street, Widmer & Spranley

## Arc = Knife = Switch.



NO SPRINGS TO BREAK.

**Always Reliable.**

Order one, you will order more.

**GENERAL REPAIRING.**

**Incandescent and Power Knife Switches, Lightning Arresters.**

**Write us.** **Get Our Discounts.**

**SINGLE AND DOUBLE POLE IRON-BOX FUSE BOXES.**

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**UTICA, N. Y.**

# Electrical Supplies and Fixtures.

**New Catalogue will be Sent on Application.**

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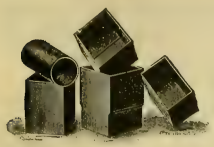
NOW READY.

## ELECTRIC TRANSMISSION HAND-BOOK.

Lieut. F. B. Badt's latest addition to our famous hand-book series, of which 45,000 copies have been sold. The new book deals in the author's well-known practical style with all the problems of Electric Power Transmission.

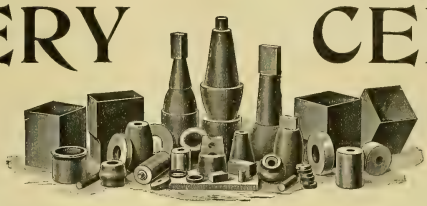
**NOW READY.** **PRICE $1.00.**

**Electrician Publishing Company,** Suite 510 Marquette Building, Chicago.



# THE FREEMAN BATTERY CELLS.





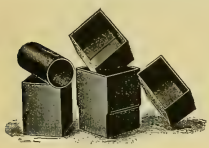
**ESTIMATES FURNISHED ON APPLICATION. PROMPT DELIVERY.**

**STANDARD SIZES ALWAYS ON HAND.**

The composition used in the manufacture of these battery cells makes them positively acid-proof, which result has never before been accomplished, providing additional strength to such an extent that this cell can be used where no other would be practical.

## THESE CELLS ARE A NEW PRODUCTION AND FULLY GUARANTEED.

**AGENTS WANTED IN ALL CITIES.** **WRITE US FOR INFORMATION AND CATALOGUE.**

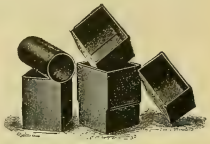


FOR PROMPT REPLY ADDRESS

J. Frank Dunbar, Treasurer,

## NEWTON RUBBER CO.,

87 SUMMER ST., BOSTON, MASS.



# The National Underground Cable Co.

**Times Building, New York. Rookery, Chicago. Betz Building, Philadelphia, Ames Building, Boston.**

This company is controlled by and is the associate of the National Conduit Manufacturing Company, and is manufacturing the well-known Norwich Paper Insulated Wires and Lead Sheathed Cables for all purposes; Electric Light, Street Railway, Telephone and Telegraph. All cables and wires guaranteed. High Potential Conductors a Specialty.

Write for further information to New York office.

## INCANDESCENT LIGHTING SUNDRIES,

Such as Cord Adjusting Balls, Gas Attachments, Socket Hoods, Wire Guards, Shade Holders, etc., to say nothing of Sockets, Switches, Lamp Cord, etc., receive our special attention. Our stock is very large and complete, and we endeavor to have

**ALL OF THE LATEST NOVELTIES**

at prices that please and sometimes astonish. At the same time we always have a

**BIG STOCK OF "STAPLES"**

at the very lowest prices the market affords.

## ELECTRIC APPLIANCE COMPANY,

ELECTRICAL SUPPLIES, 242 Madison St., CHICAGO.

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# WHY BE A FOGY?

GASKETS MADE INSTANTLY WITH

⅜ in. for **UNIONS.**

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Put up in boxes, weight 3 to 6 lbs.

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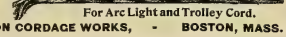
## SAMSON SPOT CORD



For Arc Light and Trolley Cord.

SAMSON CORDAGE WORKS, - BOSTON, MASS.

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# COMMERCIAL ELECTRICAL SUPPLY COMPANY

**821 Pine Street St. Louis.**

# For Electrical Goods.

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# Genuine K. W. Rosettes.

**Cleat Concealed Combination and Square Base.**

*All Dealers Have Them.* *Be Sure You Get the Genuine.*

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NAME ON EVERY BOX.

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BRIDGEPORT, CONN., AND CHICAGO.

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THE R. THOMAS & SONS CO. PORCELAIN IS GOOD.

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Can only be Secured by the use of . . . **P** and **B** Compound, Varnish, Tape, Paper.

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Send Samples for Prices.

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**HOYT STATION AMMETERS AND VOLTMETERS**

Sent free on Application.

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I-T-E AUTOMATIC MAGNETIC CIRCUIT-BREAKERS.

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## You Hang 'Em Up.

**...NO SHELVES...**
**...NO BOXES.....**

**THEY ARE**

Easy to install out of the way, can't tip over, causing endless trouble, and just what you have been looking for. Write for prices

**THAT BEAT THE WORLD.**

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SECURITY BUILDING, - ST. LOUIS, MO.

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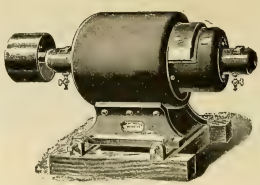

Iron Clad. Completely closed in.

DUST and Moisture Proof.

Specially adapted for direct driving machinery.

The application of Motors to machine tools a specialty.

Light weight. Slow and Medium speed.

No exterior magnetism.

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EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy.

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BARE AND INSULATED ELECTRIC WIRE,
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Two Wires in a Single Tube, the Standard Method of Electric Wiring.

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GREENFIELD, MASS., Sept. 19, 1895.

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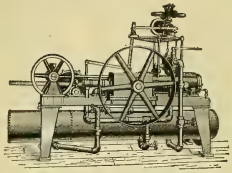
61 Hampshire Street, Boston, Mass.

GENTLEMEN:—We have one of your Governors in use at our power house at Millers Falls, Mass., taking care of two water-wheels to perfection, regulating the power *within a few volts.* We took out one Governor and replaced it with a LOMBARD GOVERNOR which gives *perfect satisfaction.* Yours truly, MONTAGUE ST. RY. Co.
(Signed) H. C. GARFIELD, Supt.



Sold on trial and absolutely guaranteed to hold wheel speed to satisfaction of purchaser, irrespective of sudden changes of load.

Send us a description of your water-wheel plant.

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FOR ELECTRICAL USES:

Graphite Rods of Various Lengths, from 1-5 Ohm to 100 Ohms Resistance to the inch. Graphite Boxes and Crucibles, Resisting Heats of 4,000 Degrees. Inquiries Gladly Answered.

JOS. DIXON CRUCIBLE CO., Jersey City, N. J.

## Are you alive to your own interest?

If so, better use our Arc Cut-Outs, Carbon Holders, Machine Brushes, Segments, Etc. Write us for prices on anything you are in need of, as we manufacture arc lighting supplies in general.

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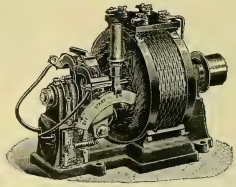
16,000 Alts., ⅛–¼–1 H. P.
7,200 " ½–¾–1–1½ H. P.

Efficient,
Non-Synchronous,
Start with
50 per cent.
Overload.



Durable,
Fully
Guaranteed,
Handsome.

PAT'D FEB. 14, 1893; SEPT. 19, 1894, AND PATENTS PENDING.

THE EMERSON ELECTRIC MFG. CO.,
Write for Prices. ST. LOUIS U. S. A.

"A" ARC AND INCANDESCENT LAMPS and IRON HANGER BOARDS "B"

THE ADAMS-BAGNALL ELECTRIC CO. CLEVELAND

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CHICAGO. NEW YORK.

WEATHER-PROOF "TRADE MARK" "O.K." LINE AND HOUSE WIRES

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PETTINGELL-ANDREWS CO., BOSTON, MASS.
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# Phillips Insulated Wire Co.,

NEW YORK OFFICE: 39 and 41 Cortlandt St.
FACTORY: Pawtucket, R. I.

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**An Excellent Opportunity for a Young Man!**

The advertiser controls valuable electric heating patents; sad irons, soldering outfits, etc.; and wants a young man, electrically educated and with some capital, to join him in pushing the electrical heating business already organized and established and with good orders on hand. A salary would be paid and young man and advertiser (business man) can control this business. Address "Heater," care WESTERN ELECTRICIAN.

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One who is now selling the electric trade in the West and Southwest, and would be willing to take up an article used by all electric roads and manufacturers, on commission. Address,

X. Y. Z., care WESTERN ELECTRICIAN.

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By a man who has the formula for making the best china for electrical purposes in the market, glazed or unglazed; also understands making all kinds of window and wall tubes of all lengths and sizes, curved tubes, etc., and all kinds of press work. Address, "A. E. X.," care

WESTERN ELECTRICIAN, Chicago.

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By young man experienced in setting up dynamos and motors. Expert armature winder and repair hand. Good at figures, rewinding for any voltage. Position with construction company preferred, or will take charge of station. Best of references. Address, "RELIABLE," Care WESTERN ELECTRICIAN.

## $5,000.00,

Will purchase one-third interest in a large and successful Electrical Supply and Construction Company located in the West; 20 per cent. per annum profits guaranteed upon investment. If you are a bookkeeper or an experienced electrician, position also at not less than $100 per month. Address

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Care of WESTERN ELECTRICIAN,

CHICAGO, ILL.

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The address of every man who is desirous of improving his position or broadening his knowledge of Electricity, and is willing to devote a little time and energy to do so.

Address,

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One 600 h. p. Corliss engine, one 300 h. p. Corliss engine; one 500 h. p. Westinghouse compound engine; one 250 h. p. Ball automatic engine; two 125 h. p. Ball automatic engines; two 80 h. p. Ball automatic engines; two 125 h. p. generators, 500 volts; four 60 h. p. generators, 500 volts; large stock of automatic engines and dynamos of every description. Also a battery of compound boilers, 700 h. p., 160 h. p. in a pair. FRANK TOOMEY, N. Y., 141 N. Third Street, Philadelphia.

## FOR SALE.

20 horse power Horizontal Tubular Steam Boiler; been used but a few months. 12 horse power Steam Engine. Both in first-class condition.

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Is hereby given that sealed proposals will be received by George B. Clark, City Clerk of said City, up to Wednesday, April 8, 1896, at 7 o'clock p. m., for the furnishing and constructing of a new Electric Light Plant. The successful contractor to receive from said city a contract for lighting the streets for a term of ten years with one hundred to one hundred and twenty-five arc lamps, 2,000 candle power, all night schedule, every night. Said city to grant to the successful contractor a franchise for commercial lighting of said city for a term of ten years.

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All work to be done and contracts entered into according to the plans and specifications now on file in the City Clerk's office, or at the office of Messrs. Pierce & Richardson, No. 1409-10 Manhattan building, Chicago, Ill., consulting engineers for the City of Madison.

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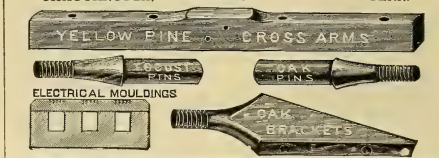


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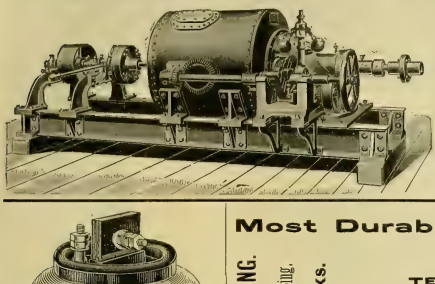

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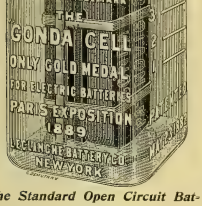


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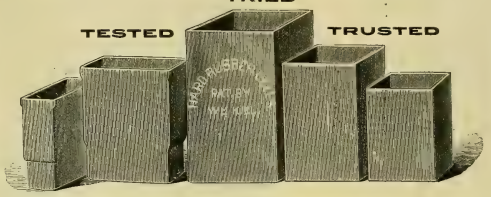

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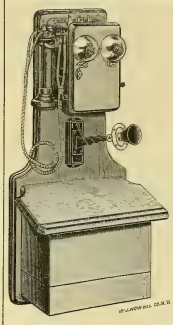

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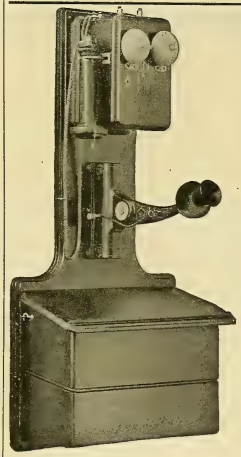

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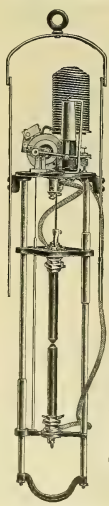
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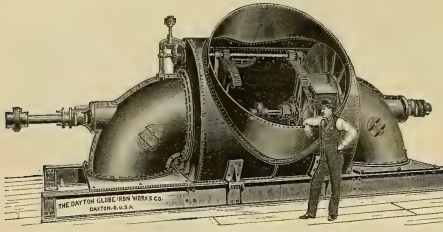


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|---|---|---|---|---|---|---|
| Whole Gate | | 16.16 | 119.17 | 141.58 | 205.27 | 79.76 |
| ⅞ | " | 16.42 | 122.00 | 137.18 | 195.19 | 82.08 |
| ¾ | " | 16.76 | 117.33 | 112.60 | 175.74 | 82.18 |
| ⅝ | " | 17.03 | 111.8 | 98.12 | 149.99 | 79.21 |
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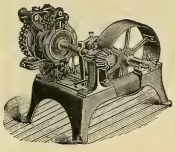

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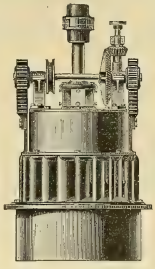

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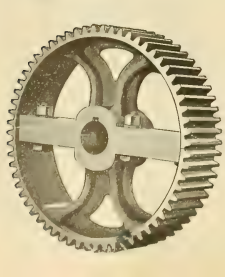

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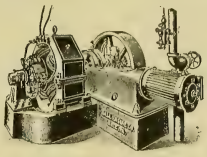

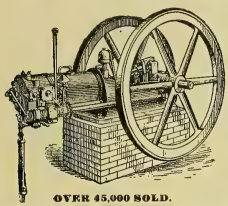

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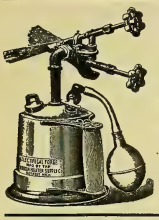

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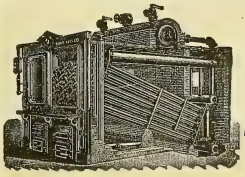

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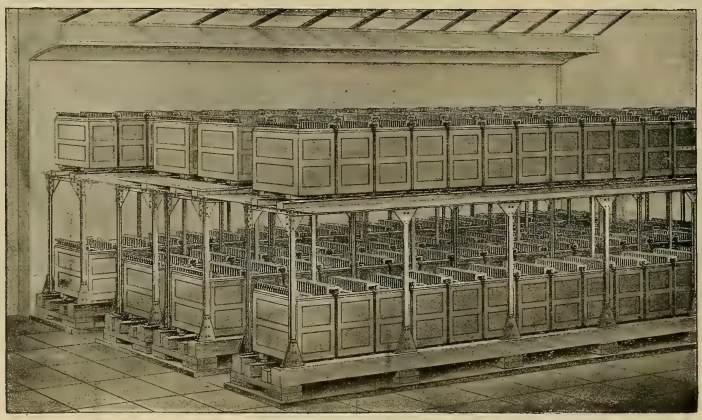

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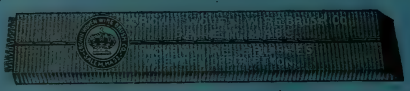

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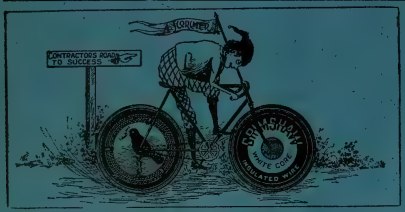


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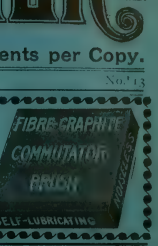

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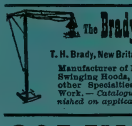

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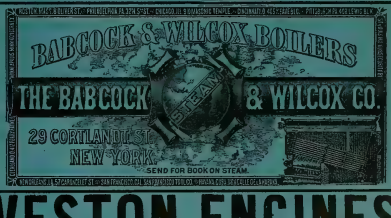


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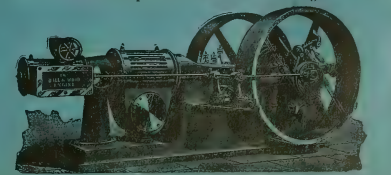

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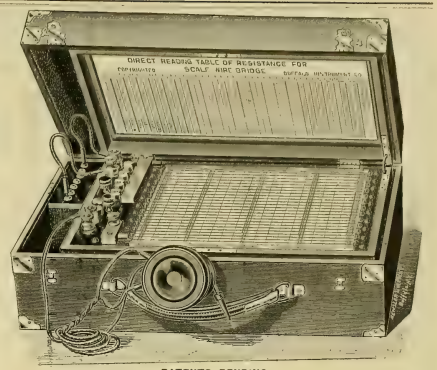


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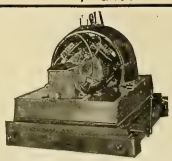

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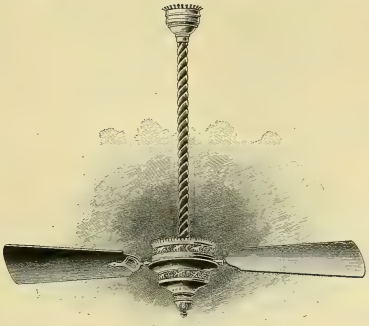

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Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.
Utica El. Mfg. & Sup. Co.

**Insulated Wires and Cables—Magnet Wires.**
American Electrical Works.
Brixey, W. R.
Central Electric Co.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
Nat'l Underground Cable Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Central Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
Eclipse Elec. Lamp Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.,
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
United Elec. Imp. Co.
Westinghouse El. & Mfg. Co.

**Lightning Arresters.**
Electric Appliance Co.
Garton-Daniels Electric Co.
General Electric Co.
Utica El. Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Manhole Covers.**
Greger Manhole Cover Co.

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Ferracute Machine Co.
Murray Iron Works Co.

**Mica.**
Bowers Bros.
Electrical Eng. Co.
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.
Schoonmaker, A. O.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Central Electric Co.
Colburn El. Mfg. Co.
Dallett & Co., Thos. H.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Menominee El. & Mech. Co.
Roth Bros. & Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Walker Mfg. Co.
Westinghouse El. & Mfg. Co.

**Oil Feeders.**
Dailey, Jas. W.

**Packing.**
Besly & Co. Chas. H.
Garlock Packing Co.
Peerless Rubber Mfg. Co.

**Paints.**
MacCurdy & Smith.
Standard Paint Co.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd.

**Platinum.**
Baker & Co.

**Poles.**
Bernardin, F. M.
Brown, DeWitt, Cedar Co.
Central Mfg. Co.
Hart, C. S.
Lindsley Bros.
Morris, Tasker & Co.
Nuttall Co., R. D.
Perrizo, Paul, Jr. Co.
Sterling, W. C. & Son.

**Porcelain.**
Commercial Elec. Sup. Co.
Empire China Works.
General Electric Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Central Electric Co.
Electric Appliance Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.

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Central Electric Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Speaking Tubes.**
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Electric Appliance Co.
Partrick & Carter Co.

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Besly & Co., Chas. H.
Buffalo Instrument Co.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Ohio Storage Battery Co.

**Street Cars.**
Brill, J. G. Co

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Brixey, W. R.
Central Electric Co.
Chicago Ins. Wire Co
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
Berliner Telephone Co.
Central Electric Co,
Clark Tel. & Const. Co.
Commercial Elec. Sup. Co.
Conn. Tel. & El. Co.
De Veau & Co.
Electrical Eng. Co,
Farr Tel. & Const. Supply Co.
Gustafson, W. A.
Keystone Telephone Co.
Mason, J. W.
Northwest Engineering Co.
Richards & Meacham.
Standard Tel. & Elec. Co.
Viaduct Mfg. Co.
Western Elec. Co.
Western Tel. Cons. Co.

**Transformers.**
Central Electric Co.
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.

**Trolley Cord.**
Bernardin, F. M.
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stilwell-Bierce & Smith Vaile Co

**Universities.**
Cor. School of Technology.
Int. Corr. Schools.

**Water Wheels.**
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas H.
Bi-Metallic El. Trans. Co.
Brixey, W. R.
Central Electric Co
Electric Appliance Co.
Independent Electric Co
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
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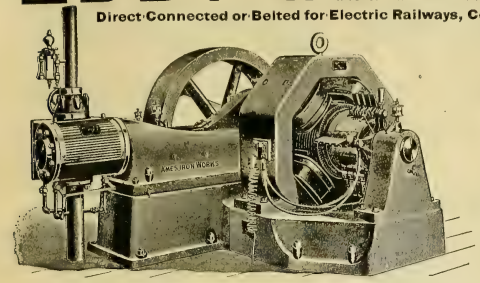
# EDDY GENERATORS.

**Direct-Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.**



**Eddy Motors—Slow, Medium or High Speed.**

**We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.**

## The Eddy Electric Mfg. Co.,

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BOSTON, G. M. Angier & Co., 64 Federal St.
ELMIRA, S. N. Blake.
ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.
CINCINNATI, O., Nevada Bldg., John A. Stewart.
CHICAGO, 305 Dearborn St., Wallace & Hine, Managers.

# BI-METALLIC WIRE.

**(Manufactured by John A. Roebling's Sons Co.)**

**Copper and Steel. Copper for Conductivity, Steel for Strength. The two combined for the "bi-metallic" effect. A Superior Conductor.**

**Telephone, Telegraph, Trolley, Electric Light and Power.**

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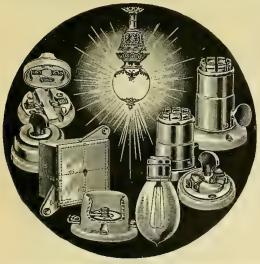
**BOSTON,**
**182 Summer Street.**

**CHICAGO,**
**1537 Monadnock Building.**



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**ANY SPECIAL FORM OF TUBE MADE TO ORDER.**

The Waterhouse-Gamble Arc Lamp. Perkins Incandescent Lamp,
Sockets, Rosettes, Switches.

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TRADE MARK

**IMPORTED**

## HIGH GRADE NUERNBERG CARBONS

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**FOR DIRECT CURRENT ARC LAMPS.** **FOR ALTERNATING CURRENT ARC LAMPS.**

**Are by far the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light, burning without any dust.**

SEND FOR LATEST PRICE LIST TO

## HUGO REISINGER,

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Sole Importer for the United States and Canada.

We are making the very best Carbons now on the market, and selling them at prices that you cannot afford to remain unaware of. Operating as we do the largest factory outside of the "Trust," with a daily capacity of 150,000 carbons, the prompt execution of large orders is assured.

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**Noblesville, Ind., U. S. A.**

**"Eyanson" Quick Break Switch.**

PATENTED JULY 16, '95.

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Formerly J. Grant High & Co.,

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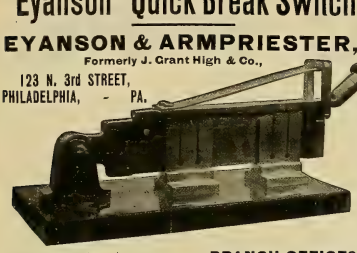
PHILADELPHIA, - PA.



Switches and Switchboards of all Descriptions.

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LOUISVILLE, KY.: 310 W. Main St., James Clark, Jr. & Co.
NEW ORLEANS, LA.: 608 Custom House Street, Widmer & Spranley.

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342 DEARBORN STREET, CHICAGO, ILL.

....We Manufacture and Sell at Wholesale....

Magneto Bells, Receivers, Induction Coils.

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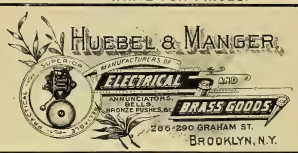


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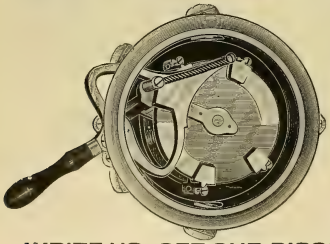
**FORT WAYNE, IND.**

Apparatus for

**Arc, Direct Current and Alternating Incandescent Lighting and Power Transmission.**

**DISC ARC CUT-OUT.**



**Always Reliable.**

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Perfect Insulation.

Order one. You will use more.

General Repairing.

Single and Double Pole Iron-Box Fuse Boxes.

Arc Knife Switches.

Lightning Arresters.

WRITE US. GET OUR DISCOUNTS.

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NOW READY.

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Lieut. F. B. Badt's latest addition to our famous hand-book series, of which 45,000 copies have been sold. The new book deals in the author's well-known practical style with all the problems of Electric Power Transmission.

**NOW READY.** **PRICE $1.00.**

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# Alternating Ceiling Fan Works.

**We Guarantee It.**

**No Commutator.**

**No Brushes.**

Uses Less Current than any Fan on the Market.

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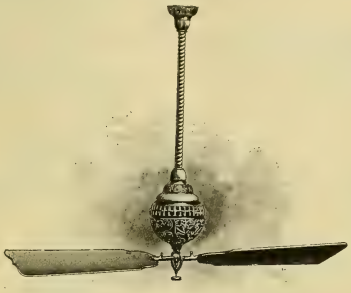
OUR DIRECT CURRENT FAN WORKS.



**Our Guarantee is Good.**

Only Fan having Blade Adjuster.

Air can be thrown UP or DOWN.

All Bearings SELF-OILING.

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Ask for New Catalogue and Discounts, and you will send us an order.

The Handsomest Fan Ever Offered to the Trade.

Fans finished in Bronze, Nickel and Polished Brass.
We manufacture a full line of Belt Fans and Water Motors.

**AGENTS WANTED IN LEADING CITIES.**

TUERK WATER METER CO., - Fulton, N. Y.

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Agent for New York, Brooklyn, Jersey City and Philadelphia. . . . . .

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**Times Building, New York. Rookery, Chicago. Betz Building, Philadelphia, Ames Building, Boston.**

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Write for further information to New York office.

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The purchase of Cheap Arc Globes is the poorest kind of economy. A Good Heavy Globe that costs slightly in advance of the thin flimsy kind will last three or four times as long.

## We Sell the Heavy Kind

**AND OUR PRICES WILL BE FOUND IN EVERY WAY SATISFACTORY.**

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Such as Battery Jars, Insulators, Shades, etc., are of the very highest grade. Our stock is large and complete, and our prices are right.

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**(ELECTRIC BRAND.)**

## FOR ELECTRICAL PURPOSES.

Guaranteed 98/99 per cent. and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

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**Can only be Secured by the use of . . .** **P** and **B** **Compound, Varnish, Tape, Paper.**

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**Send Samples for Prices.**

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The Best on the market.

**MacCurdy & SMITH,** Indianapolis, Ind.

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**OUR ALTERNATING**

# Current Ammeters

**....AND....**

## VOLTMETERS

**FOR SWITCH-BOARD WORK**

are superior to anything on the market, and our prices—well, write to us and we will tell you all about them.

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PENACOOK, N. H., U. S. A.

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# CHICAGO INSULATED WIRE CO.,

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Manufacturers of

## Portable Electric Lamps for Bicycles, Carriages, Watchmen and General Use.

**WEIGHT, 16 Ozs.** **PRICE, $5.00.**

### MINIATURE LAMPS

**For All Purposes.** In connection with our **PORTABLE LAMP** we are equipped with the most complete factory for the manufacture of the **Highest Grade** of Miniature Lamps **Exclusively.**

Our **Series Lamps** are **Unexcelled. Watch** for our new and original designs.

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For closed circuit primary batteries of every description.

**A Dry Powder** to which only **Water** is added, when wanted for use. The most convenient and inexpensive form for **LABORATORIES, MEDICAL** and **SURGICAL BATTERIES.**

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For Arc Light and Trolley Cord.

**SAMSON CORDAGE WORKS, - BOSTON, MASS.**

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Perfect in regulation and cheap to buy.

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# RAINBOW SHEET PACKING.

**HAVE YOU USED IT?**

Oils, Ammonia or Alkalies do not affect it.

Steam Joints Made Instantly.

NO BAKING OR FOLLOWING UP.

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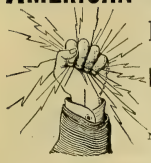
PROVIDENCE, R. I.



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INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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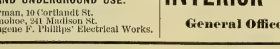
General Offices and Works: 527 W. 34th St., New York.

THE

# "CLARK" WIRE.

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For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

BRANCH OFFICE:

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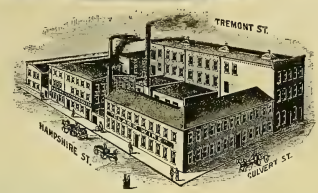
CHICAGO, ILLINOIS.




In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

EASTERN ELECTRIC CABLE CO.,

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HENRY A. CLARK, Treas. and Gen'l Mgr. HERBERT H. EUSTIS, Pres. and Electrician.

# See that Nail!

# You Hang 'Em Up.

...NO SHELVES...
...NO BOXES.....

THEY ARE

Easy to install out of the way, can't tip over, causing endless trouble, and just what you have been looking for. Write for prices

THAT BEAT THE WORLD.

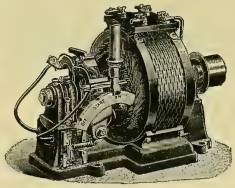
The F. J. Pearson Mfg. Co.,

SECURITY BUILDING, - ST. LOUIS, MO.

SINGLE PHASE A. C. POWER MOTORS.

16,000 Alts., ½—¾—1 H. P.
7,200 " ½—¾—1—1½ H. P.

Efficient,
Non-Synchronous,
Start with
50 per cent.
Overload.



Durable,
Fully
Guaranteed,
Handsome.

PAT'D FEB. 14, 1893; SEPT. 19, 1894, AND PATENTS PENDING.

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Write for Prices. ST. LOUIS U. S. A.

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Stamped MICA Segments and Solid Sheet MICA Segments gauged to thickness, for all the Standard Railway Motors. MICA Washers. MICA in the sheet, and cut to any size or pattern.

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MICA MICA MICA

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WESTERN ELECTRIC COMPANY,

CHICAGO. NEW YORK.

AGENCIES:

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PETTINGELL-ANDREWS CO., BOSTON, MASS.
ELECTRICAL ENGINEERING CO., MINNEAPOLIS, MINN.
ST. LOUIS ELECT'L SUPPLY CO., ST. LOUIS, MO.
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# Phillips Insulated Wire Co.,

NEW YORK OFFICE: 39 and 41 Cortlandt St. FACTORY: Pawtucket, R. I.

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**An Excellent Opportunity for a Young Man!**

The advertiser controls valuable electric heating patents and irons, soldering outfits, etc., and wants a young man, electrically educated and with some capital, to join him in pushing the electrical heating business already organized and established and with good orders on hand. A salary would be paid and young man and advertiser (business man) can control this business. Address "**Heater,**" care WESTERN ELECTRICIAN.

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**The Electric Supply & Construction Co.,**

**Kansas City, - - - MO.**

## BUSINESS OPPORTUNITY.

Advertiser wishes to connect himself with established good electrical business, manufacturing, merchandising or contracting. Would furnish some capital. Give particulars. Address **"D,"** Care WESTERN ELECTRICIAN, 510 Marquette Bldg.

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## FOR SALE.

Luling Electric Light & Power Co. Plant. For particulars apply to

**OTIS McGAFFEY, JR., Sec'y,**

**Luling, Texas.**

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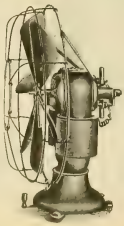

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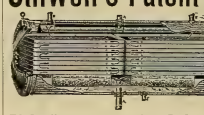

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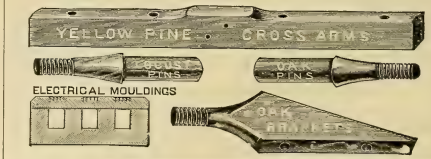


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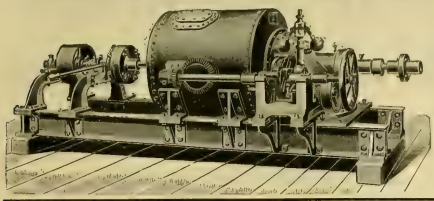

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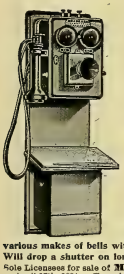

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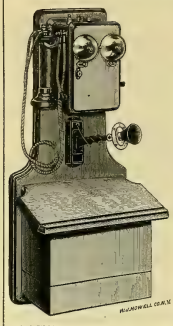

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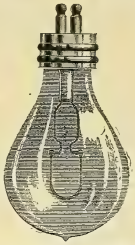

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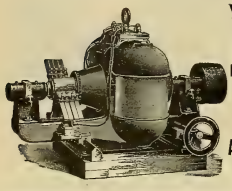

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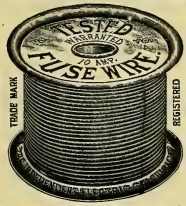

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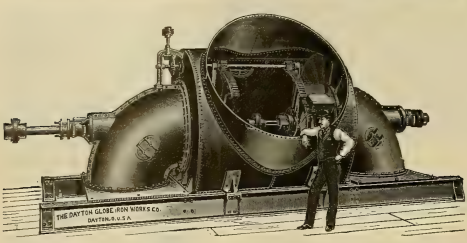


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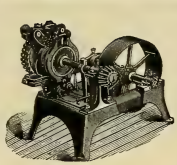

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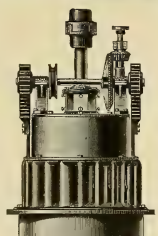

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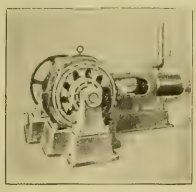

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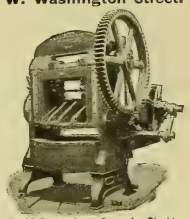
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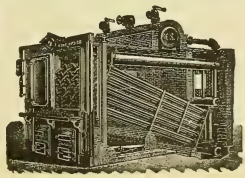

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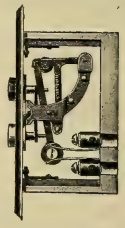

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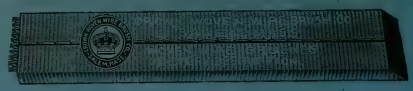

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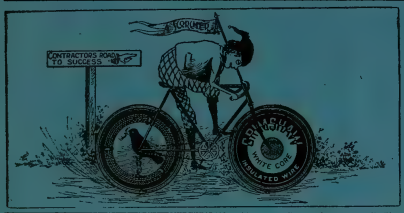


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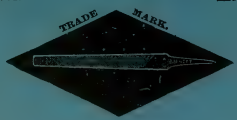


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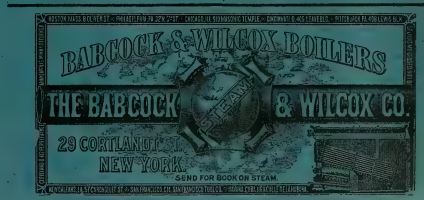

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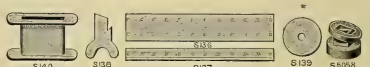


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Electric Storage Battery Co.
Ohio Storage Battery Co.

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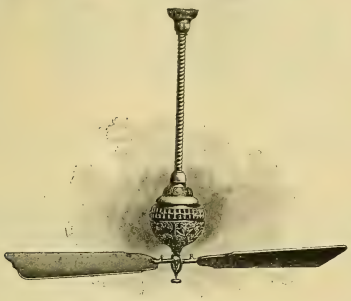

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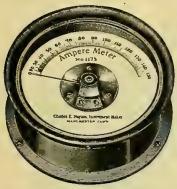

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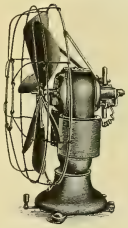

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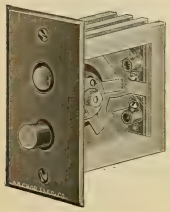

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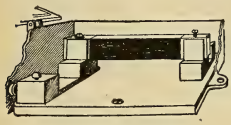

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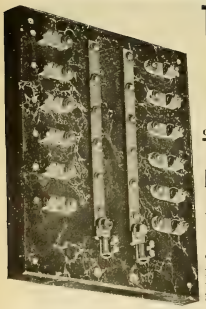

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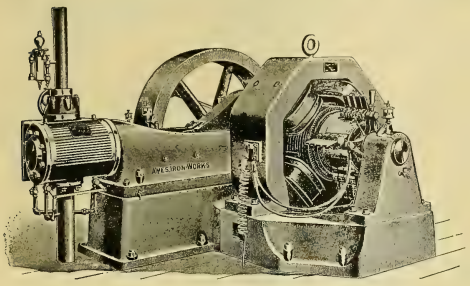

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FOR

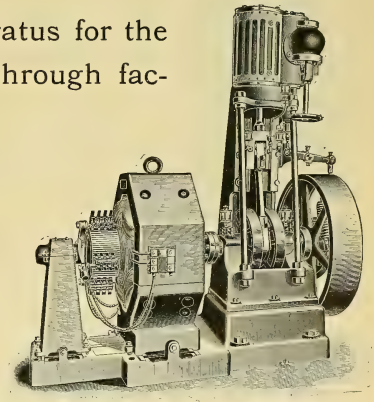
ELECTRIC RAILWAYS,
CENTRAL STATIONS,
ISOLATED LIGHTING

OR

POWER PLANTS.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.



## All Our Apparatus Guaranteed As Represented.

## The Eddy Electric Manufacturing Company,

**WINDSOR, CONN.**

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Philadelphia, Walter C. McIntire & Co., 506 Commerce St.
Boston, G. M. Angier & Co., 64 Federal St.
Elmira, S. N. Blake.
St. Louis, Western Electrical Supply Co.
Kansas City, W. T. Osborn.

**Western Office: 305 Dearborn St., Chicago, Wallace & Hine, Western Agents.**

# For Sale Cheap.

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## "Electrical Engineer"

OF NEW YORK.

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No. 1 Plate for 5 and 10 Amp. Hart Switches.

# HART FLUSH SWITCHES.

New Face Plate.

**BETTER PROPORTIONS. BETTER FINISH. MORE DURABLE.**

Made of solid plate brass $\frac{1}{8}$-inch thick, with beveled edges.

Better Design,
Better Material,

Self-Adjusting Handle,
No Breaking,

No Binding on Face Plates,
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Handles, Switches and Face Plates Interchangeable.

Single Plates for all sizes of Hart Switches.
Gang Plates for any number of Hart Switches.

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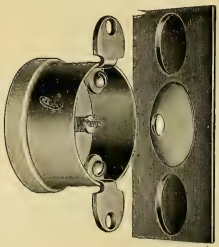
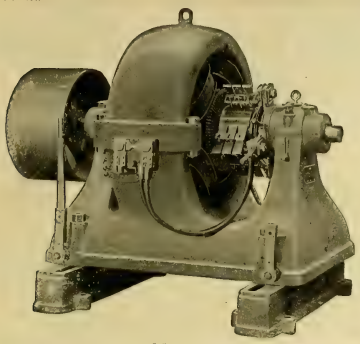


Back of No. 1 Plate.

**THE HART & HEGEMAN MFG. CO., HARTFORD, CONN.**



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Manufacturers of all kinds of Electrical Apparatus, specially large size

## GENERATORS,

## Street Railway Motors,

## INCANDESCENT MACHINES, ETC., ETC.

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# The S. K. C. Two Phase Alternating Current System.

**THE FIRST AND ONLY COMPLETE AND PERFECTED SYSTEM BY WHICH LIGHT AND POWER CAN BE SUPPLIED FROM THE SAME GENERATOR AND CIRCUITS. POWER TRANSMISSION AND DISTRIBUTION MADE PRACTICAL AND COMMERCIALLY SUCCESSFUL.**

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Our system is much more simple and consequently more durable than any other, either direct or alternating.

Our generator is much more efficient than any other alternator, requires less attention and absolutely no supplies except lubricant for bearings.

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We have entirely eliminated from our generators the usual sources of trouble, expense and interruption of service: i. e., the revolving armature, commutator, collector rings, brushes, etc.

They can be built for any voltage from 110 for isolated lighting to the high voltages required for power transmission work; in latter case doing away with the expense and loss of step-up transformers; the usual central station machine can be connected at will for either 1,000 or 2,000 volts.

The motors excel in simplicity of construction; in starting torque and simplicity of starting device; in efficiency in the manner in which they take current in proportion to their load, and in uniformity of speed under different conditions of load.

Our transformers insure satisfactory service and the greatest economy. We are prepared to fill all orders promptly, and carry a full stock of transformers in Chicago.

**Patents**—**Our apparatus is novel; different from anything heretofore made, and covered by patents that fully protect us and our customers. We are not infringing patents belonging to others, and shall avail ourselves of the patents under which we operate to protect ourselves from piracy by other manufacturers.**

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**The Royal Electric Co., Montreal, Can., are exclusive licensees for the manufacture of the S. K. C. System in the Dominion of Canada.**

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## The largest and most completely equipped Electrical Manufacturing Establishment in the World.

**POWER, INCANDESCENT AND ARC LIGHTING, FROM THE SAME CIRCUITS.**

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Genuine K. W. Rosettes.

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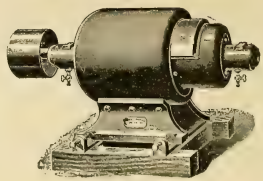

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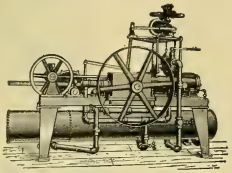

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Send us a description of your water-wheel plant.

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You Hang 'Em Up.
...NO SHELVES...
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Easy to install out of the way, can't tip over, causing endless trouble, and just what you have been looking for. Write for prices
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SINGLE PHASE A. C. POWER MOTORS.
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7,200 " ½—¾—1—1½ H. P.

Efficient,
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Start with
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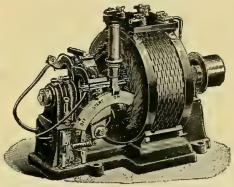

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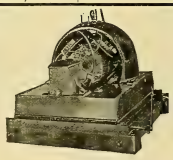

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The adverser controls valuable electric heating patents-sad irons, soldering outfits, etc.-and wants a young man, electrically educated and with some capital, to join him in pushing the electrical heating business already organized and establ shed and with good orders on hand. A salary would be paid and young man and adverliser (business man) can equit this business. Address **"Heater,"** care WESTERN ELECTRICIAN.

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Situation as superintendent of an electric light plant, or combined electric light and water works plant. Have had considerable experience in both. Have held present position over 4 years and only resign for change on account of my wife's health. Am strictly temperate and can furnish best of references as to character and ability. Address "Water Works," care Western Electrician, 510 Marquette Bldg., Chicago.

## BUSINESS OPPORTUNITY.

Advertiser wishes to connect himself with established good electrical business, manufacturing, merchandising or contracting. Would furnish some capital. Give particulars. Address **"D,"** Care WESTERN ELECTRICIAN. 510 Marquette Bldg.

## POSITION WANTED.

All around man for Street Railway or Electric Light. Good Engineer and Machinist and first-class Electrician; any system. Familiar with making tests, repairs and construction work. Address **"H,"** care WESTERN ELECTRICIAN.

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As Superintendent of Light or Power Plant, by an ambitious man having a stock of "horse sense" gained by nine years' practical experience in erecting and running plants. Familiar with the prominent electric systems; up in high-grade engineering and economy in the production and use of steam. Accustomed to the handling of men; ability to make drawings and estimates. Only object in leaving present position (traveling) is to be located permanently. Would consider a nominal salary. No objection to location. Al references Address

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The proprietor of an electrical manufacturing business, producing an established and well endorsed line of apparatus accessory to the alternating system, desires the association of gentleman of good reputation and habits, as partner. Must be able to invest a few thousand dollars and his services, both of which are desired for the purpose of pushing our product actively in the market and extending the business. Must be a man of enterprise and push, and preferably with some experience in selling electrical apparatus, and not averse to occasional traveling. Factory excellently equipped and located in large city within 100 miles of Chicago. Profits large and present expenses very low. As a legitimate business investment, this will prove to the proper party a most desirable opportunity. Address "PROPRIETOR," care WESTERN ELECTRICIAN, 510 Marquette Bldg., Chicago.

**...PROPOSALS TO...**

## Electric Light Contractors and Investors.

CITY OF MADISON, INDIANA.

## NOTICE

Is hereby given that sealed proposals will be received by George B. Clark, City Clerk of said City, up to Wednesday, April 8, 1896, at 7 o'clock p. m., for the furnishing and constructing of a new Electric Light Plant. The successful contractor to receive from said city a contract for lighting the streets for a term of ten years with one hundred to one hundred and twenty-five arc lamps, 2,000 candle power, all night schedule, every night. Said city to grant to the successful contractor a franchise for commercial lighting of said city for a term of ten years.

The said contractor to build, construct, equip and operate approximately three miles of electric street railway and receive from said City of Madison a franchise therefor of thirty years.

All work to be done and contracts entered into according to the plans and specifications now on file in the City Clerk's office, and at the office of Messrs. Lockes & Richardson, No. 1409-10 Monadnock building, Chicago, Ill., consulting engineers for the City of Madison. Inspection of plans and specifications and proposals upon application to either of the above parties.

GEORGE B. CLARK,
City Clerk.

**Bargains in Machinery for Street Railways.**

One 600 h. p. Corliss engine, one 300 h. p. Corliss engine; one 300 h. p. Westinghouse compound engine; one 250 h. p. Ball automatic engine; two 125 h. p. Ball automatic engines; two 80 h. p. Ball automatic engines; two 135 h. p. generators, 500 volts; four 60 h. p. generators, 500 volts; large stock of automatic engines and dynamos of every description. Also a battery of compound boilers, 700 h. p., 160 h. p. in a pair. FRANK TOOMEY, 131 N. Third Street, Philadelphia.

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One 300 drop Utica Telephone Switchboard, good as new; elegantly made of cherry, in table form. Cash $250.00.

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**$575!**
**FOR SALE!**
**New 50 Light**
**2,000 Candle Power**
**Arc Dynamo.**
**Complete with**
**Usual accessories.**
**Manufactured by**
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**This machine is**
**New, not second-hand,**
**But advertiser has**
**No use for it and**
**It will be sold for**
**$575 cash.**
**Address CASH,**
**WESTERN ELECTRICIAN**
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Controlling interest in an electric light plant in a town of 5,000 inhabitants. Capital stock, $15,000.00. Bonded for $10,000.00. Net profits for last six months of 1895 on basis of 20% per annum. City contract seven years to run. Coal (slack) 40 cts. per ton at plant. 44 arc lights and 1,000 incandescent lights in circuit. Interest of 81 shares and an adjoining lot 166½ ft. by 400 ft. for pond and other purposes offered for $12,000.00. Good reasons for selling. For particulars address,

"LIGHT," Western Electrician Office.

## FOR SALE,

### A Modern Electric Light and Power Plant,

Consisting of six 100 H. P. McCormack Cylinder Gate Water Wheels, set in six stone flumes, all in glit-edged blue, with best of shafting, foundations, brick building, etc., all new. Two Russell Automatic Engines of 450 H. P. capacity, for use in case of emergencies. One 60 H. P. power generator, three alternating dynamos of 3,500 light capacity and seven are dynamos of 300 light capacity. A five-year city street lighting contract, 100 lights, also excellent commercial patronage. Excellent water power lease for thirty years at $10 per H. P. per year.

A snap for the right man; owners going away. Will bear closest investigation.

Location is a prosperous manufacturing Indiana town of 15,000 people.

—Address the owner—

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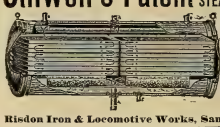

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**Telegraph, Telephone, Electric Light**
**AND STREET RAILWAY POLES.**
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*Manufacturer of*
FLAT, COILED AND WIRE
## STEEL SPRINGS
OF EVERY DESCRIPTION.
Send sample for prices. **Bristol, Conn.**

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**Can furnish any Size, Shape or pattern. Write for samples and quotations.**

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Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work.—*Catalogues and Prices furnished on application.*

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All about it for the asking.

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CHATTANOOGA, MANUFACTURERS AND DEALERS IN TENN.

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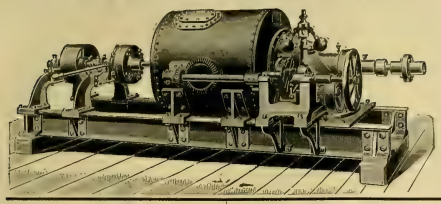

**Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.**

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

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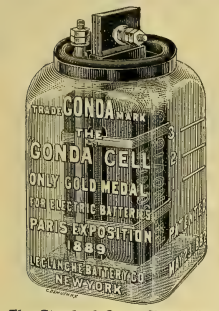


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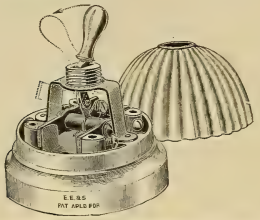


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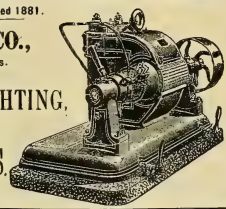

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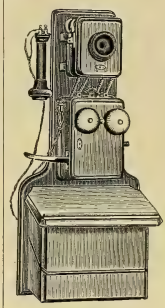

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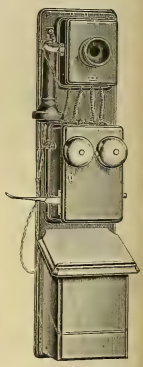

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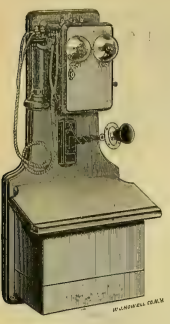

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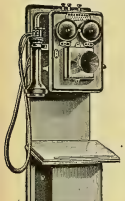

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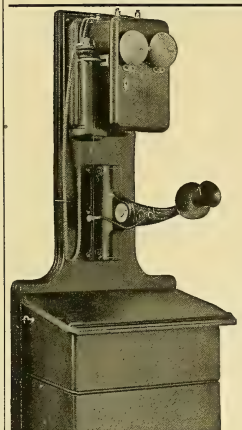

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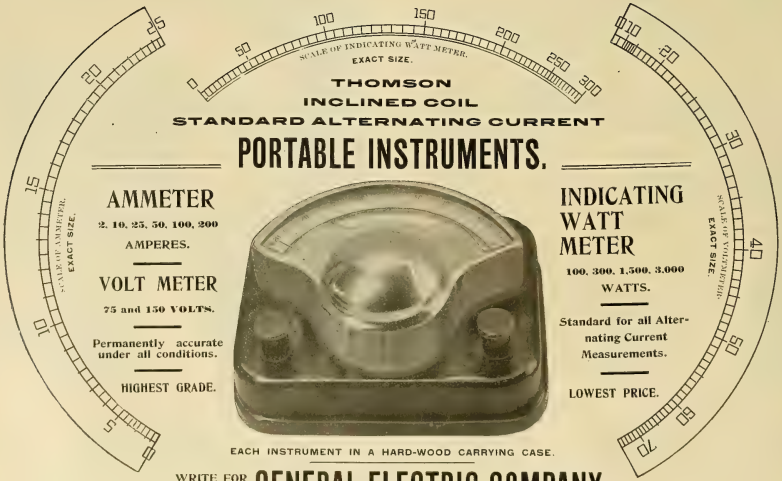


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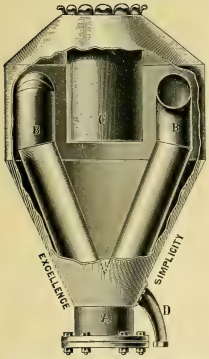

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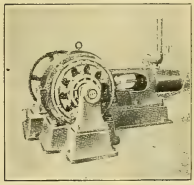
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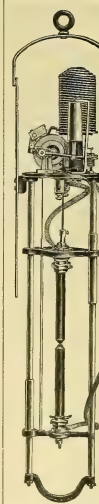
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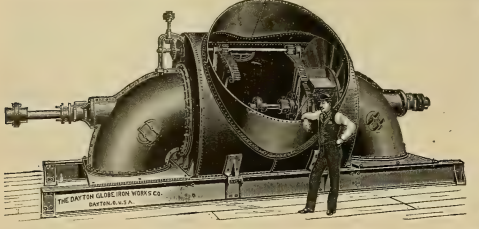


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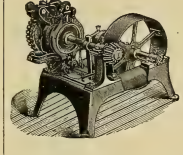

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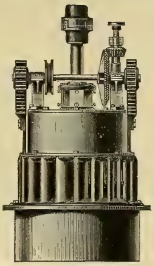

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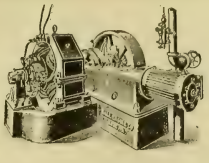

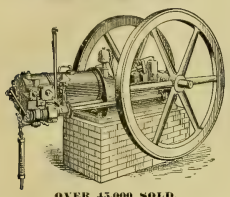

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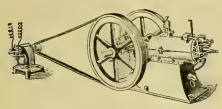

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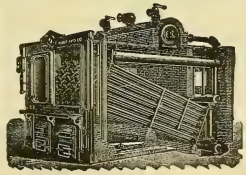

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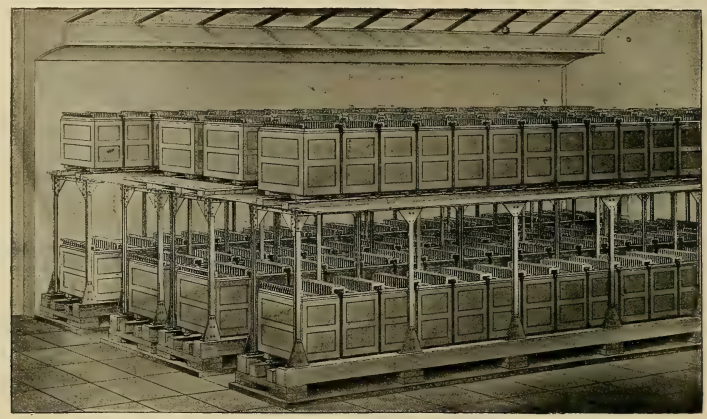

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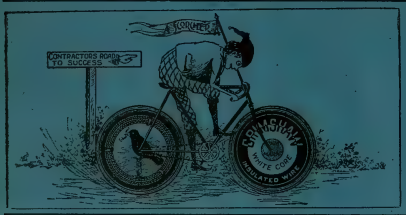


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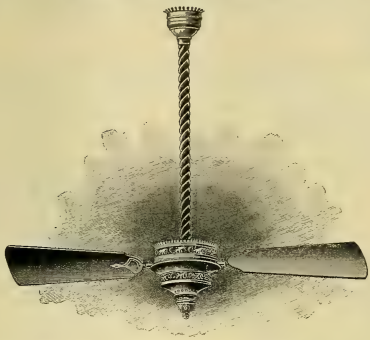

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**Cored and Solid for Direct Lighting.**

## ...LARGE IMPORTATION JUST ARRIVED...

General Western Agents:

## Chicago Edison Company,

**..DEALERS IN ELECTRIC LIGHTING SUPPLIES..**

**Edison Building, 139 Adams Street, CHICAGO, ILL.**

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## *JUST NOW*

Fan Motor you intend to handle this season. Is the time to decide on the best, if its intrinsic merit is considered. Our direct current motor is equal to

**Annunciators, Medical Farradic Batteries.**

MAGNETO, HAND AND POWER

**...GENERATORS...**

**INDUCTION AND SPARK COILS, ETC., ETC.**

**WRITE FOR CATALOGUE**

## Menominee Electrical and Mechanical Co.,

**MENOMINEE, MICH.**

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## Gordon Primary Battery

EXCELS IN

Long Life, Efficiency,
Economy, Adaptability.
It is Absolutely Non Freezing,
Labor Saving,
Free from Local Action,
Freedom from Gases and Odors.
Superior Generation of Energy.

These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America.
Send for descriptive circular and price list.
We guarantee all our Cells.

MANUFACTURED BY

**The Gordon-Burnham Battery Co.,**
**82 West Broadway, New York.**

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## NEW ERA IN ELECTRIC ADVERTISING.

Each lamp is a single letter, which greatly simplifies the construction of a sign, and permits an unlimited advertising display. This sign is low-priced, economical of operation, easily read, very conspicuous, and may be changed in a moment from one form of words to another.
We manufacture High Grade Incandescent Lamps. Lamps of any voltage furnished.

**Ask your NEAREST SUPPLY HOUSE for Sample or write**

## DICKINSON ELECTRIC SUPPLY CO.,

**High Grade Incandescent Lamps,**

American Tract Society Building, NO. 150 NASSAU STREET, NEW YORK.

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## "J.P." STYLES of TROLLEY HANGERS.

Strong and Light,
Highest Grade Workmanship and Material.

**Moulded Mica Insulation.** **Vulcabeston** Controller Parts, etc.

*SEND FOR REVISED PRICE LIST.*

**H. W. JOHNS MFG. CO.,**

240-242 Randolph Street, CHICAGO.

NEW YORK. PHILADELPHIA. BOSTON.

No. 900 No. 905.

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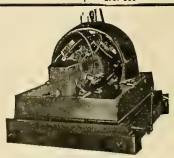
Generators for Power Transmission or Isolated Lighting.
CARD Generators are all Multipolar and Slow Speed.

AGENTS WANTED IN UNOCCUPIED TERRITORY.



75 K. W GENERATOR.

## CARD

Multipolar Slow Speed Stationary Motors.
Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

**THE CARD ELECTRIC COMPANY,**
Office and Works, Mansfield, Ohio.

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## INCANDESCENT LAMPS

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

Monadnock Building, Chicago. **THE BUCKEYE ELECTRIC CO., Cleveland, O.**

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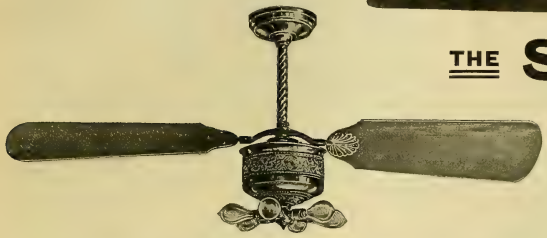
SEASON 1896.



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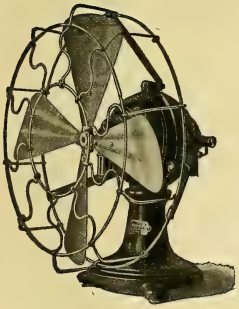

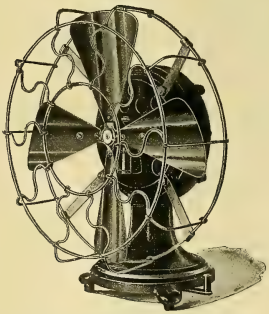

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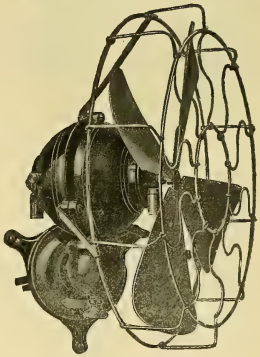

# Interior Conduit & Insulation Co.,

## GENERAL OFFICES AND WORKS:

NORTHWESTERN AGENTS:
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...CHICAGO, ILL...

527 West 34th Street, NEW YORK.

# American Electric Heating CORPORATION,

*Sears Building, - - BOSTON, MASS.*

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**Electric Vulcanizer for Bicycle Tires.**

**Write for further particulars.**

**American Electric Heating Corporation.**

25 PER CENT. BELOW COST. 25 PER CENT. BELOW COST.

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**THE JONES BROS. ELECTRIC CO.,**

126 E. COURT ST., CINCINNATI, O.

25 PER CENT. BELOW COST. 25 PER CENT. BELOW COST.


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General Electric Co.
Interior Conduit & Ins. Co.
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Walker Mfg. Co.
Westinghouse El. & Mfg. Co.

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General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

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Commercial Elec. Sup. Co.
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Weber Gas & Gaso'l Eng. Co.

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American Engine Co.
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Ball Engine Co.
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Racine Hardware Co.
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Westinghouse El. & Mfg. Co.

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Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Partrick & Carter Co.
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Union Heater Supply Co.

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Andrae & Sons Co., J.
Berliner Telephone Co.
Bernardin, F. M.
Besly & Co., Chas. H.
Bryant Electric Co.
Central Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
Fuller-Warren Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Kester Elec. Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Metropolitan Elec. Mfg. Co.
Morrison Southern El. Co.
National Electric Co.
Northwest Engineering Co.
Norton, C. E.
Ohio Electric Works.
Partrick & Carter Co.
Pearson, F. J. Mfg. Co.
Phila. Elec. & Mfg. Co.
Sioux City Brass Works.
Standard Tel. & Elec. Co.
Utica El. Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

**Globes and Electrical Glassware.**
Chicago Gen'l Fixture Co.
Edgerton Pottery Co.
Phoenix Glass Co.

**Gov'nors, Water Wheel.**
Lombard Water Wheel Gv. Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

**Hard Rubber Goods.**
Fiberite Co., The.

**Insulators and Insulating Materials.**
Anchor Electric Co.
Anderson, Albert & J. M.
Beardsley Mfg. Co.
Bernardin, F. M.
Brixey, W. R.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Eyanson & Arnpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.
Utica El. Mfg. & Sup. Co.

**Insulated Wires and Cables—Magnet Wires.**
American Electrical Works.
Brixey, W. R.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Johns Mfg. Co., H. W.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
Nat'l Underground Cable Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
Eclipse Elec. Lamp Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
United Elec. Imp. Co.
Westinghouse El. & Mfg. Co.

**Lighting Arresters.**
Electric Appliance Co.
Garton-Daniels Electric Co.
General Electric Co.
Utica El. Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Manhole Covers.**
Gregor Manhole Cover Co.

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Ferracute Machine Co.
Murray Iron Works Co.

**Mica.**
Bowers Bros.
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Munsell & Co., Eugene.
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**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

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Bates & Bro., D. L.
Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Colburn El. Mfg. Co.
Dallett & Co., Thos. H.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
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Menominee El. & Mech. Co.
Northern Electl. Mfg. Co.
Roth Bros. & Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Walker Mfg. Co.
Westinghouse El. & Mfg. Co.

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Dailey, Jas. W.

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Peerless Rubber Mfg. Co.

**Paints.**
MacCurdy & Smith.
Standard Paint Co.

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Phosphor Bronze Sm. Co. Ltd.

**Platinum.**
Baker & Co.

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Brown, De Witt, Cedar Co.
Central Mfg. Co.
Hart, C. S.
Lindsley Bros.
Morris, Tasker & Co.
Nuttall Co., R. D.
Perrizo, Paul, Jr. Co.
Sterling, W. C. & Son.
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**Porcelain.**
Commercial Elec. Sup. Co.
Empire China Works.
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**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Electric Appliance Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.

**Rheostats.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Sal Ammoniac.**
Kilpatrick & Co., A.

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Electric Appliance Co.
Partrick & Carter Co.

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Besly & Co., Chas. H.
Norton, C. E.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Ohio Storage Battery Co.

**Street Cars.**
Brill, J. G. Co.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Chicago Ins. Wire Co.
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephone and Telephone Material.**
Andrae & Sons Co., J.
Berliner Telephone Co.
Chicago Telephone Sup. Co.
Commercial Elec. Sup. Co.
Conn. Tel. & Elec. Co.
De Veau & Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co.
Gustafson, W. A.
Keystone Telephone Co.
Mason, J. W.
Northwest Engineering Co.
Richards & Meacham.
Standard Tel. & Elec. Co.
Vladuct Mfg. Co.
Western Elec. Co.
Western Tel. Cons. Co.

**Transformers.**
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.

**Trolley Cord.**
Bernardin, F. M.
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Rejiogle Governor Wks.
Smith S Morgan.

**Universities.**
Cor. School of Technology.
Jas. Forge Schools.

**Water Wheels.**
Leffel & Co., Jas.
Rejiogle Governor Wks.
Smith S Morgan.

**Wire Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
B.-Metallic El. Trans. Co.
Brixey, W. R.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Standard Underground C. Co.
Standard Underground C. Co.
Western Electric Co.

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American Carbon Co.
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Chicago Edison Co.
Chicago General Fixture Co.
General Electric Co.
Mason, J. W.
Partridge Carbon Co.
Reisinger, Hugo.
Schiff, Jordan & Co.
Solar Carbon & Mfg. Co.
Standard Paint Co.
Wertheim, Ed.
Western Electric Co.

**Cigar Lighters.**
National Electric Co.

**Compound.**
Standard Paint Co.

**Conduits.**
Interior Conduit & Ins. Co.

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Bain, Foree.
Brush Electric Co.
Bryan & Humphrey.
Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas H.
Bowers Bros.

**Copper Wires.**
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Besly & Co., Chas H.
Brixey, W. R.
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General Electric Co.
Independent Electric Co.
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Mason, J. W.
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National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

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Samson Cordage Wks.

**Cross-Arms, Pins and Brackets.**
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Brady, T. H.
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Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Mason, J. W.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anchor Electric Co.
Anderson, Albert & J. M.
Bernardin, F. M.
Bryant Electric Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Eyanson & Arnpriest.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Elec. Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
MacCurdy & Smith.
Mason, J. W.

**Dynamos.**
American Engine Co.
Beardsley Mfg. Co.
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Card Electric Co.
Colburn Elec. Mfg. Co.
Dallett & Co., Thos. H.
Eddy Elec. Mfg. Co.
Electrical Eng. Co.
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Interior Conduit & Ins. Co.
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Siemens & Halske Elec. Co.
Toomey, Frank.
Walker Mfg. Co.
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**Electric Heating.**
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Bryan & Humphrey.
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Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
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Nuttall Co., R. D.
Partrick & Carter Co.
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Pearson, F. J. Mfg. Co.
Phila. Elec. & Mfg. Co.

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Besly & Co., Chas. H.
Co-burn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Norman Co., J. J.
Otto Gas Engine Wks.
Weber Gas & Gaso'l Eng. Co.

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Ball & Wood Co., The.
Ball Engine Co.
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Racine Hardware Co.
Toomey, Frank.
Weston Engine Co.

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Chic. Electro & Stereo Co.

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Faucett, I. L.

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**Forges.**
Union Heater Supply Co.

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Brixey, W. R.
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Fiberite Co., The.
General Electric Co.
Independent Electric Co.

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Peerless Rubber Mfg. Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

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Anchor Electric Co.
Anderson, Albert & J. M.
Andrae & Sons Co., J.
Berliner Telephone Co.
Bernardin, F. M.
Besly & Co., Chas. H.
Bryant Electric Co.
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Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
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Dickinson Elec. Supply Co.
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Fuller-Warren Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Kester Elec. Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Metropolitan Elec. Mfg. Co.
Morrison Southern El. Co.
National Electric Co.
Northwest Engineering Co.
Norton, C. E.
Ohio Electric Works.
Partrick & Carter Co.
Pearson, F. J. Mfg. Co.
Phila. Elec. & Mfg. Co.
Sioux City Brass Works.
Standard Tel. & Elec. Co.
Utica El. Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

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Edgerton Pottery Co.
Phoenix Glass Co.

**Gov'nors, Water Wheel.**
Lombard Water Wheel Gv. Co.

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Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

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Fiberite Co., The.

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Anderson, Albert & J. M.
Beardsley Mfg. Co.
Bernardin, F. M.
Brixey, W. R.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Eyanson & Arnpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
MacCurdy & Smith.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.
Utica El. Mfg. & Sup. Co.

**Insulated Wires and Cables—Magnet Wires.**
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Brixey, W. R.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Johns Mfg. Co., H. W.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
Nat'l Underground Cable Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
Eclipse Elec. Lamp Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
United Elec. Imp. Co.
Westinghouse El. & Mfg. Co.

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Electric Appliance Co.
Garton-Daniels Electric Co.
General Electric Co.
Utica El. Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Manhole Covers.**
Gregor Manhole Cover Co.

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Ferracute Machine Co.
Murray Iron Works Co.

**Mica.**
Bowers Bros.
Electrical Eng. Co.
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.
Schoonmaker, A. O.

**Mining Apparatus, Elec.**
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Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
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Beardsley Mfg. Co.
Brush Electric Co.
Card Electric Co.
Colburn El. Mfg. Co.
Dallett & Co., Thos. H.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Menominee El. & Mech. Co.
Northern Electl. Mfg. Co.
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Storey Motor & Tool Co.
Walker Mfg. Co.
Westinghouse El. & Mfg. Co.

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Dailey, Jas. W.

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Garlock Packing Co.
Peerless Rubber Mfg. Co.

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Standard Paint Co.

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Phosphor Bronze Sm. Co. Ltd.

**Platinum.**
Baker & Co.

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Lindsley Bros.
Morris, Tasker & Co.
Nuttall Co., R. D.
Perrizo, Paul, Jr. Co.
Sterling, W. C. & Son.
Valentine-Clark Co.

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Empire China Works.
General Electric Co.

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Electrician Publishing Co.

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National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.

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Kilpatrick & Co., A.

**Speaking Tubes.**
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**Speed Indicators.**
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Norton, C. E.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

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Ohio Storage Battery Co.

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Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
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Standard Paint Co.

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Western Electric Co.

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Chicago Telephone Sup. Co.
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Conn. Tel. & Elec. Co.
De Veau & Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co.
Gustafson, W. A.
Keystone Telephone Co.
Mason, J. W.
Northwest Engineering Co.
Richards & Meacham.
Standard Tel. & Elec. Co.
Vladuct Mfg. Co.
Western Elec. Co.
Western Tel. Cons. Co.

**Transformers.**
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.

**Trolley Cord.**
Bernardin, F. M.
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Rejiogle Governor Wks.
Smith S Morgan.

**Universities.**
Cor. School of Technology.
Jas. Forge Schools.

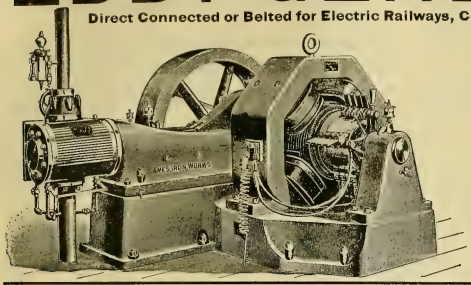
**Water Wheels.**
Leffel & Co., Jas.
Rejiogle Governor Wks.
Smith S Morgan.

**Wire Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas. H.
B.-Metallic El. Trans. Co.
Brixey, W. R.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Standard Underground C. Co.
Standard Underground C. Co.
Western Electric Co.


**For Alphabetical Index of Advertisements see Page III.**

# EDDY GENERATORS.

**Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.**



**Eddy Motors—Slow, Medium or High Speed.**

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

## The Eddy Electric Mfg. Co.,

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ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.
CINCINNATI, O., Nevada Bldg., John A. Stewart.
CHICAGO, 305 Dearborn St., Wallace & Hine, Managers.

# FOR SALE CHEAP.

A small holding of PREFERRED STOCK
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**For full information and particulars address**

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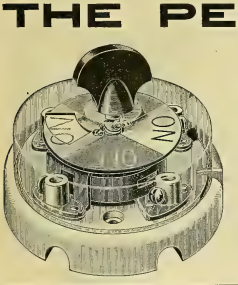
# THE PERKINS DIAL SWITCH.




For current of from 5 to 50 amperes, and as high as 500 volts.

Shows when current is "ON" or "OFF." Handles a street railway current for lights ....or car heaters....

Our Crookes' Tubes Take Pictures.

**SEND FOR NEW CATALOGUE.**

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# The "Electra" Carbons.

**IMPORTED**

**HIGH GRADE NUERNBERG CARBONS**

ELECTRA *TRADE MARK*

ELECTRA *TRADE MARK*

**FOR DIRECT CURRENT ARC LAMPS.** **FOR ALTERNATING CURRENT ARC LAMPS.**

**Are by far the most economical and efficient manufactured. They produce a very brilliant and absolutely steady light, burning without any dust.**

SEND FOR LATEST PRICE LIST TO

## HUGO REISINGER,

**NO. 38 BEAVER STREET, NEW YORK.**
Sole Importer for the United States and Canada.

DON'T WORRY YOUR BRAIN OVER

## Mathematical Problems

When you can buy the
Best Switches at . . .
Reasonable Prices . .

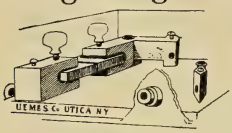
# ANCHOR SWITCHES

....Are the Best....

## ANCHOR ELECTRIC CO., Boston, Mass.

CHICAGO OFFICE, Suite 1654-5-6 Monadnock Block,
C. O. BAKER, Manager.

## A Lightning Arrester THAT Works.




CARBON ADJUSTABLE POINTS,
**Simple and Positive.**
Order one and you will order more.
GENERAL REPAIRING.

SINGLE AND DOUBLE POLE IRON-BOX FUSE BOXES.

**Arc Knife Switches, Disc Arc Cut-Out.**

GET OUR DISCOUNTS. WRITE US.

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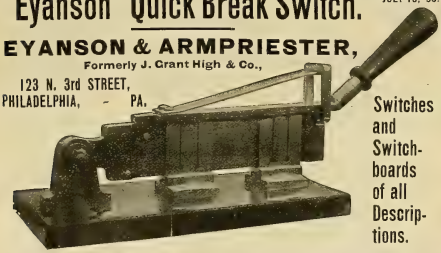
## "Eyanson" Quick Break Switch.

PATENTED JULY 16, '95.

**EYANSON & ARMPRIESTER,**
Formerly J. Grant High & Co.,
123 N. 3rd STREET,
PHILADELPHIA, - PA.



Switches and Switchboards of all Descriptions.

Write for our new catalogue "D."

BRANCH OFFICES:
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LOUISVILLE, KY.: 313 W. Main St., James Clark, Jr. & Co.
NEW ORLEANS, LA.: 608 Custom House Street, Widmer & Sprangley.

# A PERFECT MANHOLE COVER.

**Not Expensive.**
**Horses cannot slip on it.**
**Streets can have an even surface.**

SEE WHAT IS IN OUR FAVOR

A "Greger" Cover Covers a Surface 4 ft. 6 in. x 5 ft.
Old Style Cover Covering Surface 2 ft. 8 in. x 4 ft. 2 in.
CAN BE USED ON OLD MANHOLE FRAME.

LIBERAL ARRANGEMENTS for Parties to Manufacture in all Leading Cities.
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Farr Telephone & Const. Supply Co.,
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....We Manufacture and Sell at Wholesale....
Magneto Bells, Receivers, Induction Coils.
WRITE FOR PRICES.

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MANUFACTURERS OF
ELECTRICAL AND BRASS GOODS
ANNUNCIATORS, BELLS, BRONZE PUSHES, &c.
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## Fort Wayne Electric Corporation,
FORT WAYNE, IND.

Apparatus for
**Arc, Direct Current and Alternating Incandescent Lighting and Power Transmission.**

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We are making the very best Carbons now on the market, and selling them at prices that you cannot afford to remain unaware of. Operating as we do the largest factory outside of the "Trust," with a daily capacity of 150,000 carbons, the prompt execution of large orders is assured.

## THE AMERICAN CARBON CO.,

Noblesville, Ind., U. S. A.

# THIS ALTERNATING CEILING FAN WORKS.

**We Guarantee It.**

**No Commutator.**

**No Brushes.**

...Uses Less Current than any Fan on the Market...

**Our Direct Current Fan Works.**

**Our Guarantee is Good.**

Only Fan having Blade Adjuster.

Air can be thrown UP or DOWN.

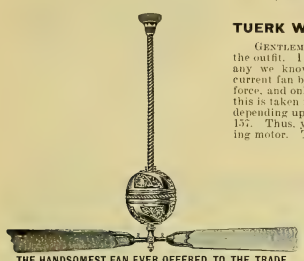
All Bearings SELF-OILING.

Ask for New Catalogue and Discounts, and you will send us an order.

Fans finished in Bronze, Nickel and Polished Brass.

We manufacture a full line of BELT FANS and WATER MOTORS.

AGENTS WANTED IN LEADING CITIES.



THE HANDSOMEST FAN EVER OFFERED TO THE TRADE.

**TUERK WATER METER CO., Fulton, N. Y.**

SCHENECTADY, N. Y., March 25, 1896.

GENTLEMEN:—We have made a test of your ceiling fan, using our motor, and must say we are very much pleased with the outfit. I think you have struck the right combination for an alternating fan, and one which is much cheaper than any we know of. It might be interesting to you to know that you cannot judge of the energy taken by an alternating current fan by multiplying the voltage and ampere readings, because there is a lag of the current behind the electromotive force, and only an indicating wattmeter should be used for measuring the energy. We think the motor is efficient when this is taken into consideration. Our tests, for instance, show that the apparent watts vary from about 243 to 260 watts, depending upon the angle at which the fans are set. The actual watts read by an indicating wattmeter vary from 130 to 157. Thus, you will see there is considerable difference between the apparent watts and the actual watts of the alternating motor. The ratio between these two is known as the power factor, and in this case varies from .52 to .57.

Yours truly,
GENERAL ELECTRIC CO.
Per H. C. Wirt, Engineer Supply Dep't.

## Tuerk Water Meter Co., FULTON, N. Y.

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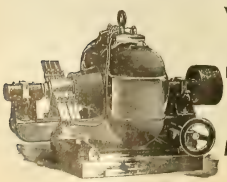

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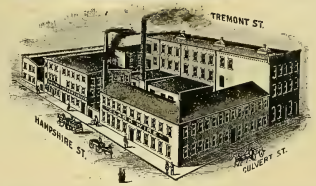


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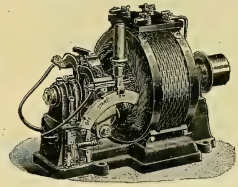

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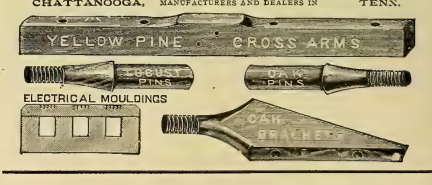


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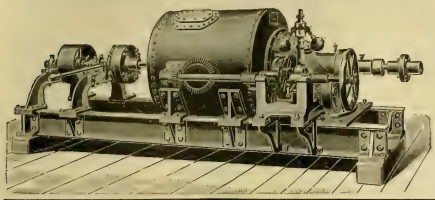

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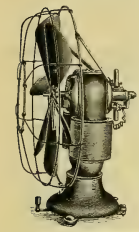

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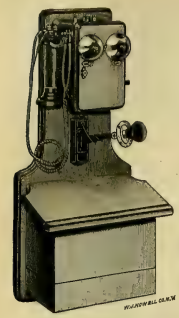

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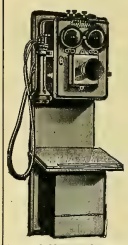

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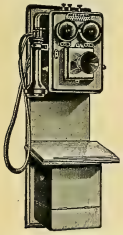

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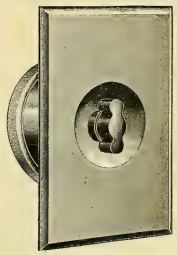

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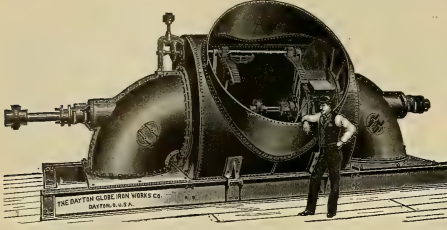


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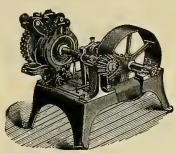

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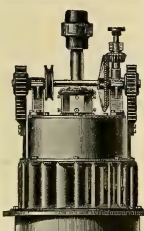

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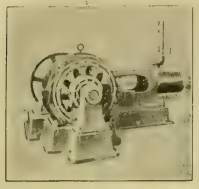

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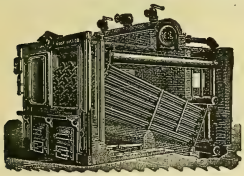

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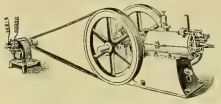

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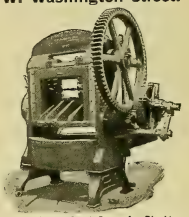

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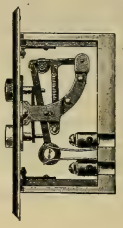

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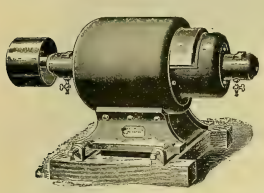

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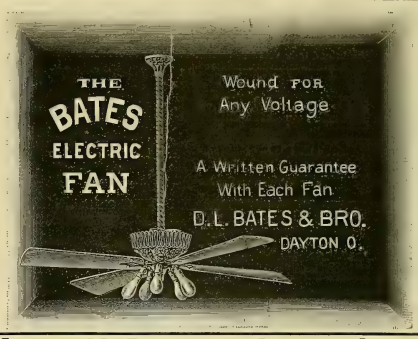

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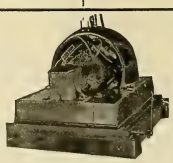

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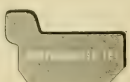

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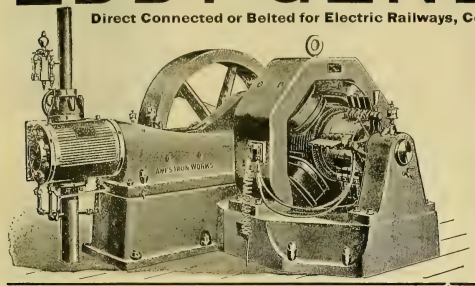

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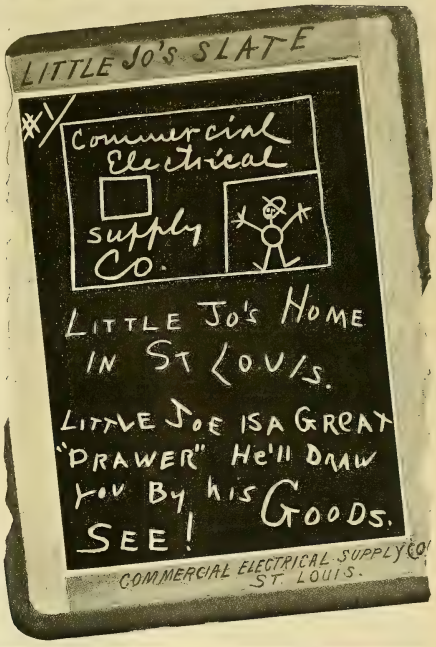


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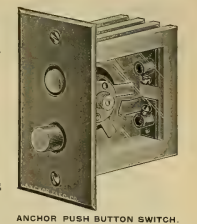

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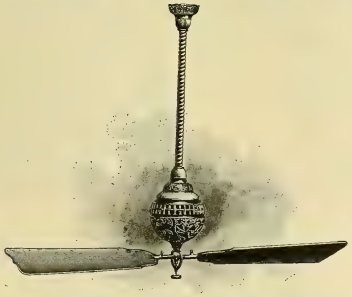

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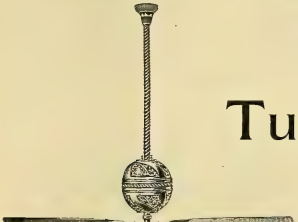

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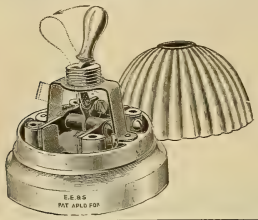


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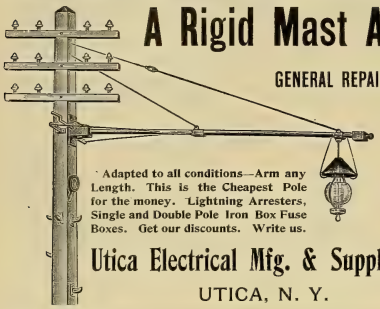

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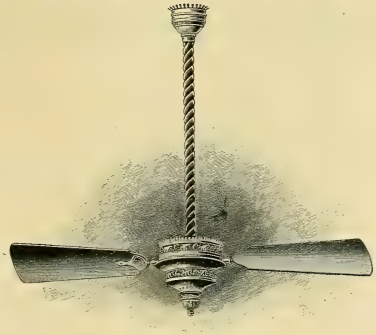

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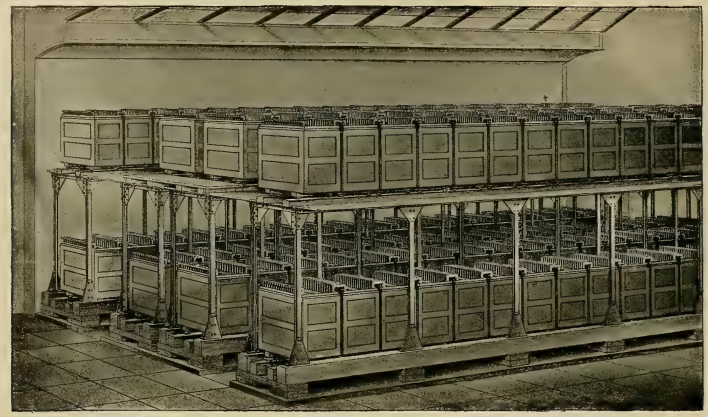

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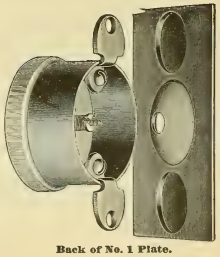

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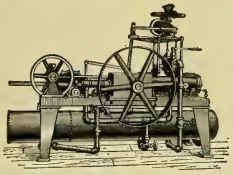

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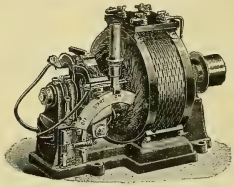

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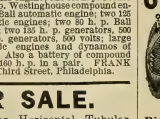

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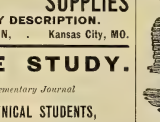

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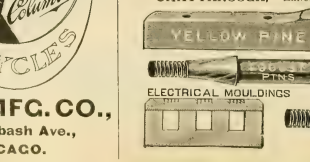
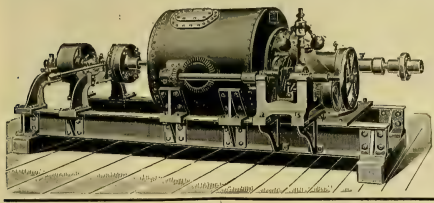


# Victor Turbine Water Wheel.



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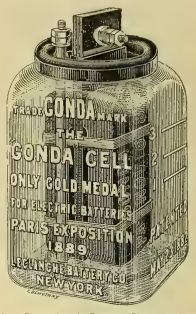


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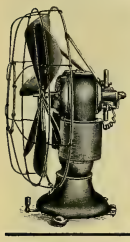

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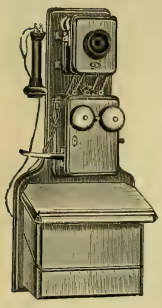

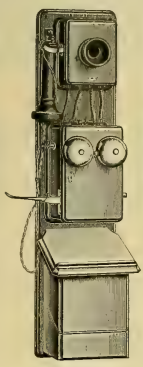

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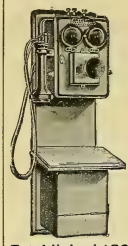

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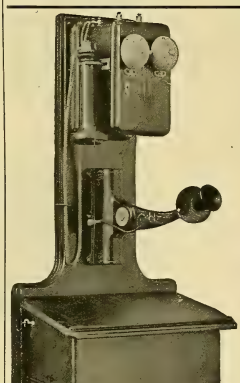

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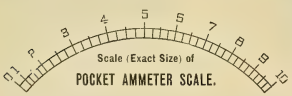
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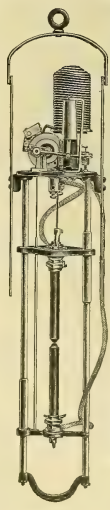

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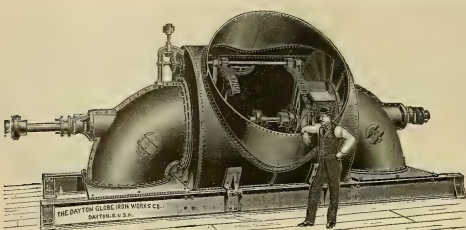


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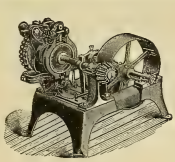

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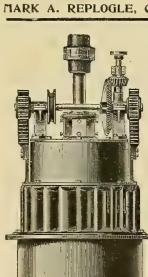

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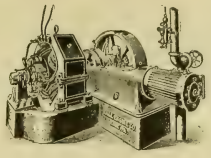

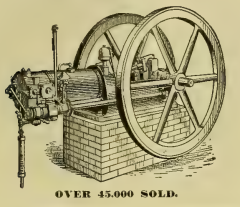

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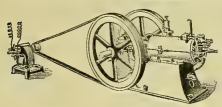

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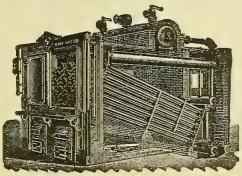

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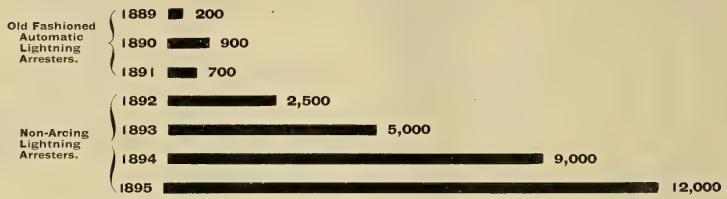


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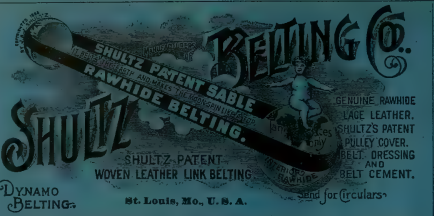


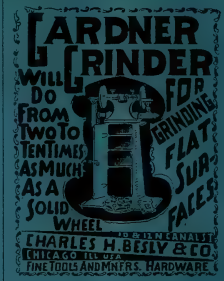

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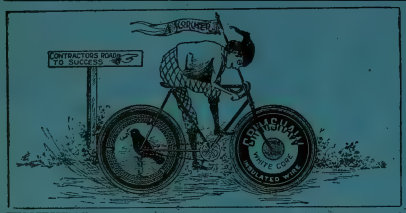


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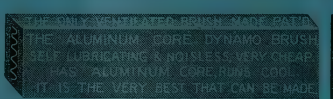


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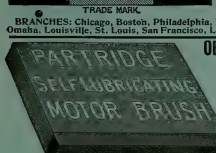


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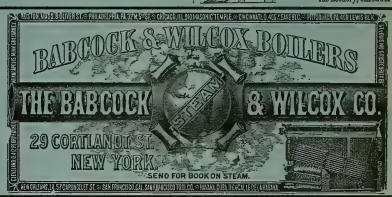


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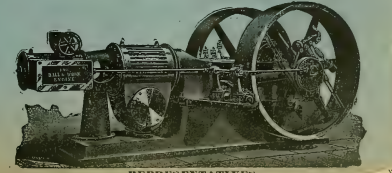

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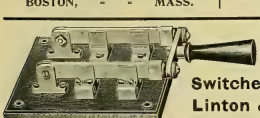

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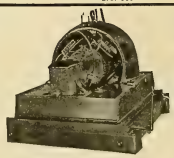

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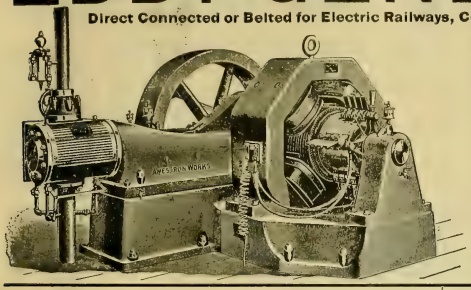

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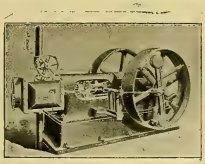

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Independent Electric Co.
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Metropolitan Electric Co.
Moore, Alfred F.
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Nat'l Underground Cable Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
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Buckeye Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
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Electric Appliance Co.
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General Electric Co.,
Orient Electric Co.
Partrick & Carter Co.
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United Elec. Imp. Co.
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General Electric Co.
Utica El. Mfg. & Sup. Co.
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Bliss Co., E. W.
Ferracute Machine Co.
Murray Iron Works Co.

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Electrical Eng. Co.
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.
Schoonmaker, A. O.

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Brush Electric Co.
Card Electric Co.
Colburn El. Mfg. Co.
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Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
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Interior Conduit & Ins. Co.
Mayo, V. J.
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Northern Electl. Mfg. Co.
Roth Bros. & Co.
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Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
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**Platinum.**
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Commercial Elec. Sup. Co.
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Farr Tel. & Const. Supply Co.
Keystone Telephone Co.
Manhattan Elec. Sup. Co.
Mason, J. W.
Northwest Engineering Co.
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**We Guarantee It.**

**No Commutator.**

**No Brushes.**

Uses Less Current than any Fan on the Market.

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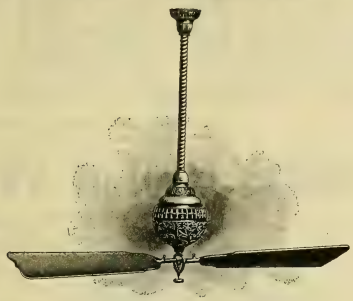
OUR DIRECT CURRENT FAN WORKS.



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Only Fan having Blade Adjuster.
Air can be thrown UP or DOWN.
All Bearings SELF-OILING.

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Ask for New Catalogue and Discounts, and you will send us an order.

The Handsomest Fan ever offered to the trade.

Fans Finished in Bronze, Nickel and Polished Brass.
We manufacture a full line of Belt Fans and Water Motors.

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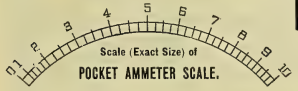


Scale (Exact Size) of POCKET AMMETER SCALE.

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**AMMETER SIZES: 2, 10, 25 AMPERES.**

**SMALL ENOUGH TO BE CARRIED IN**

## COAT POCKET.

Thomson Pocket Ammeter, 4⅛ by 3½ inches.

**VOLTMETER SIZES: 75 AND 150 VOLTS.**

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# THOMSON POCKET VOLTMETER.

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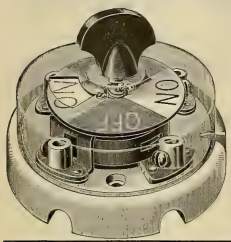


For current of from 5 to 50 amperes, and as high as 500 volts.

Shows when current is "ON" or "OFF." Handles a street railway current for lights ....or car heaters....

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## JUST NOW

Fan Motor you intend to handle this season. Is the time to decide on the best, if its intrinsic merit is considered. Our direct current motor is equal to

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MAGNETO, HAND AND POWER

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## Electric Motors and Generators,

MANUFACTURED BY

**THOS. H. DALLETT & CO.,**

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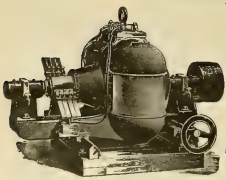
PHILADELPHIA, PA.



Portable Electric Drills, Starting Boxes and Controllers,

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Apparatus for

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HIGHLY FINISHED IN
Japan,
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Polished Brass
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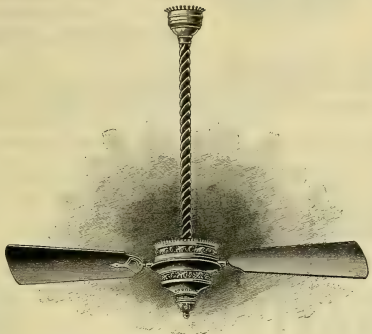

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HART FLUSH SWITCH.
Solid Face Plate,
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All Sizes of Hart Switches.
GANG PLATES FOR ANY NUMBER.
Self-Adjusting Handle.
NO BREAKAGE.
Always the Right Pressure on Face Plate.

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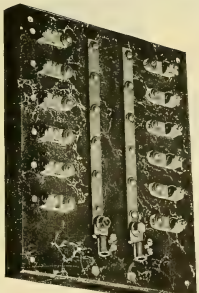

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of all descriptions.
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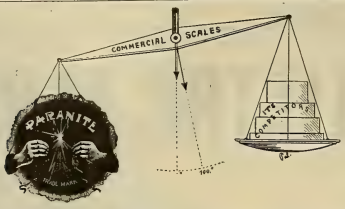


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SAMSON SPOT CORD
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I-T-E Automatic Magnetic
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The Steam Engineering course is intended to qualify engineers to secure Licenses.
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OUR ALTERNATING
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VOLTMETERS
FOR SWITCH-BOARD WORK
are superior to anything on the market, and our prices—well, write to us and we will tell you all about them.
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MICA IN CHICAGO.
We have opened a branch house at 153 Lake Street, Chicago, to accommodate our western customers, and will carry a full assortment of all grades of Mica for electrical insulation, our goods formerly having been sold through W. H. Sills & Co., as sales agents.
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Perfect in regulation and cheap to buy.
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No Wear on Commutator.
No Sparking Under Varying Load.
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FIBRE-GRAPHITE COMMUTATOR BRUSH
SELF-LUBRICATING

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of approved sizes and types; also CANDELABRA, DECORATIVE and MINIATURE LAMPS, and electrically illuminated signs. . . . . .
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PACKING
Expressly for High Speed Engines. Will Hold 400 lbs. Steam.
20 YEARS OLD AND NO EQUAL.
Manufactured Exclusively by
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FOR ELECTRICAL PURPOSES.
Guaranteed 98/99 per cent. and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

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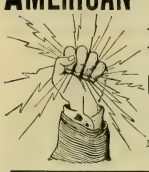

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AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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Suitable for Isolated Plants and Feeder Circuits in Power Plants. Unsurpassed in appearance and workmanship.

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The handsomest tested Instrument, and for less money, than you can purchase in this country.

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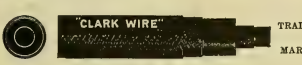
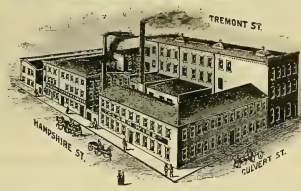
For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

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We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

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HENRY A. CLARK, Treas. and Genl. Mgr. HERBERT H. EUSTIS, Pres. and Electrician.

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*Sears Building, - - BOSTON, MASS.*

We are making **Laundry Irons, Tailors' Gooses, Small Stoves**—just the thing for a thousand uses—**Curling Iron Heaters,** as well as a full line of **Cooking Devices, Up-to-Date Street Car and Special Electric Air Heaters.**

Electric Vulcanizer for Bicycle Tires.

**Write for further particulars.**

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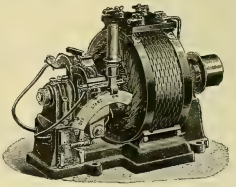
## SINGLE PHASE A. C. POWER MOTORS.

16,000 Alts., ½–¾–1 H. P.
7,200 " ½–¾–1–1½ H. P.

Efficient,
Non-Synchronous,
Start with
50 per cent.
Overload.



Durable,
Fully
Guaranteed,
Handsome.

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THE EMERSON ELECTRIC MFG. CO.,
Write for Prices. ST. LOUIS U. S. A.

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EXCELS IN

Long Life, Efficiency,
Economy, Adaptability.
It is Absolutely Non Freezing,
Labor Saving,
Free from Local Action,
Freedom from Gases and Odors.
Superior Generation of Energy.

These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America.
Send for descriptive circular and price list. We guarantee all our Cells.

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The Gordon-Burnham Battery Co.,
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WEATHER-PROOF
TRADE MARK
"O.K."
LINE AND HOUSE WIRES

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The advertiser controls valuable electric heating patents; sad irons, soldering outfits, etc. Land wants a young man, electrically educated and with some capital, to join him in pushing the electrical heating business already organized and established and with good orders on hand. A salary would be paid and young man and advertiser (business man) can control this business. Address **"Heater,"** care WESTERN ELECTRICIAN.

**WANTED.**

Situation as superintendent of an electric light plant, or combined electric light and water works plant. Have had considerable experience in both. Have held present position over 4 years and only desire to change on account of my wife's health. Am strictly temperate and can furnish best of references as to character and ability. Address **"Water Works,"** care **Western Electrician,** 510 Marquette Bldg., Chicago.

**WANTED.**

Position by young man having had large practical experience with electric lighting and power machinery, and understands arc light repairing; also experienced in the care of steam plants. Can give good references.

Address **"J. V. E.,"**
Care WESTERN ELECTRICIAN.

**WANTED.**

**First-Class Armature Winder.**

**LOUNSBURY & CO.,**
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**WANTED.**

One 80 light and 40 light armature core for Standard Electric Co.'s arc dynamo. State condition and lowest cash price.

**CHICAGO ARMATURE CO.,**
**197 So. Canal St., CHICAGO.**

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| MOTORS. | DYNAMOS. |
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| One 1 horse power. | One 38 lt. 16 c. p. dynamo. |
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| One 5 horse power. | One 100 lt. 16 c. p. dynamo. |
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| One 10 horse power. | One 60 k. w. alternator; one 30 k. w. D. C. compound wound generator. Machines all new. Address **V. J. MAYO,** 100 N. Clinton St., Chicago. |

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One 1,000 light inc and scent dynamo and one 100 light incandescent. Both direct current, compound wound.

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Three 500 light Thomson-Houston 110 volt dynamos with belts and instruments complete, and one 100 h. p. Ideal engine in good order. For sale at a bargain if taken at once. They are now being replaced by three 1,000 light National dynamos and three 100 h. p. Ideal engines.

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**FOR SALE.**

A 1,500-light Fort Wayne Alternating Incandescent Dynamo, with Exciter. Second-hand, but in perfect order. Address

**THE S. FREEMAN & SONS MFG. CO.,**
**Racine, Wis.**

**$575!**
FOR SALE!
New 50 Light
2,000 Candle Power
Arc Dynamo,
Complete with
Usual accessories.
Manufactured by
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This machine is
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# PROPOSALS.

Sealed proposals will be received by the West Chicago Park Commissioners, at their office in Union Park, until 4 o'clock p. m. of Tuesday, May 12th, 1896, for furnishing and installing the following apparatus and machinery comprising the Arc Light Plant to be located in Garfield Park:

Sec. "A"—500 H. P. Water Tube boilers in two units.

Sec. "B"—Automatic Stoker and Furnace for same.

Sec. "C"—Coal and Ash Conveyors and Storage Bins.

Sec. "D"—Condensers and Pumps.

Sec. "E"—Open Heaters and Steam Separators.

Sec. "F"—650 H. P. Cross Compound Corliss Steam Engine.

Sec. "G"—Jack-Shaft, Clutch-Pulleys and Rope-Drive.

Sec. "H"—7 125 Light Arc Dynamos or 6 150 Light Arc Dynamos.

Sec. "I"—750 Series, Double-service, 2,000 C. P. Arc Lamps.

Sec. "J"—300,000 feet Underground Cable, 30,000 feet Rubber Covered Wire.

Sec. "K"—Marble Switchboard.

Sec. "L"—Masonry for Foundations, etc.

Sec. "M"—Two-ton Pulley Block and Crane.

In accordance with plans and specifications on file in the office of Mr. Foree Bain, electrical and mechanical engineer, Monadnock Block, Chicago, Ill., a copy of said plans and specifications being also on file in the office of the Engineer of said Park Commissioners in Union Park.

Bidders may figure on the work under each section, or as many sections of the specifications as herein named as they may desire. Contracts will be awarded under each section separately.

The time specified for completing the work under the several sections varies from 90 to 120 days from the notice to proceed, and the contractor will be required to furnish a bond from a surety company doing business in the City of Chicago and acceptable to the West Chicago Park Commissioners, in the sum equal to one-half the value of the contract price, guaranteeing the faithful performance of the contract in accordance with the specifications and within the time specified. He will also be required to furnish a similar bond to the satisfaction of the Commissioners, guaranteeing them against any damage done to any Park property or any damage that may result from accident to any person or thing through the operation of this contractor in the performance of his contract, and also guaranteeing the Commissioners against any liability, damage or loss through any patent suits for royalties or any litigation that may arise from the use of any device, machinery or apparatus that may be furnished by the said contractor.

The proposals must be made out upon blank forms contained in each section of the specifications, which must be filled out by the contractor, thus completing his proposal. Any portion that can not be guaranteed by the contractor must be plainly erased before being submitted as a guaranteed proposal.

Proposals must be sealed and addressed to the West Chicago Park Commissioners, and endorsed on the envelope in the wording heading each specification, for instance: Proposals to furnish boilers must be endorsed "Boilers, Section A;" to furnish boilers and engines must be endorsed "Boilers and Engines, Sections A and F."

The proposals must be accompanied with 5 per cent. of the amount of the bid, which must be in currency or a certified check, drawn on a responsible bank doing business in the City of Chicago and made payable to the West Chicago Park Commissioners.

No proposals will be considered unless the terms of the specification in regard to submitting proposals have been strictly complied with, and the parties tendering it shall furnish evidence satisfactory to the commissioners of his or their ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract should it be awarded.

The West Chicago Park Commissioners reserve the right to reject any and all bids.

HARVEY T. WEEKS, Pres.
Attest: GEO. F. TALTY, Secy.


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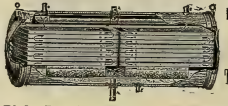

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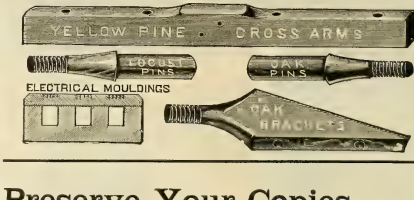


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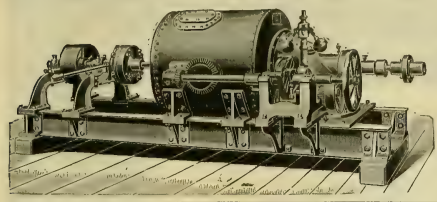

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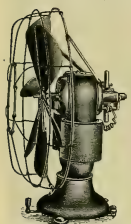

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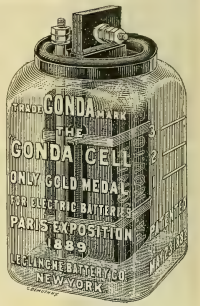


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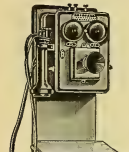

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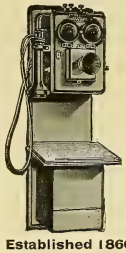

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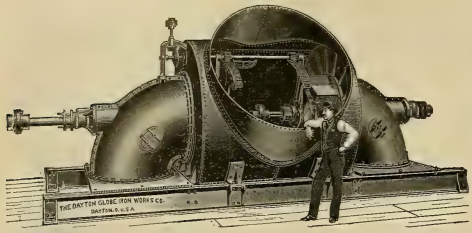


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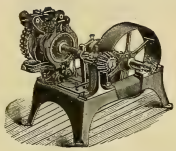

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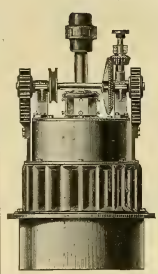

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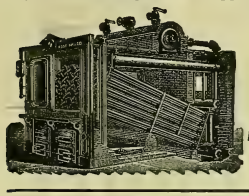

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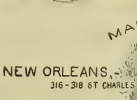


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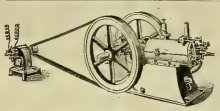

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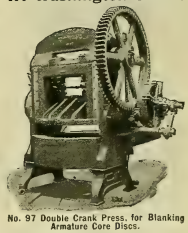

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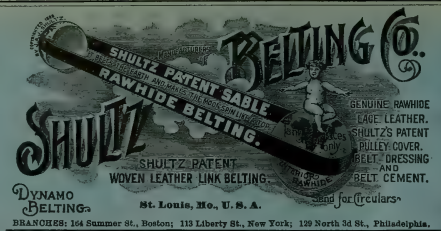
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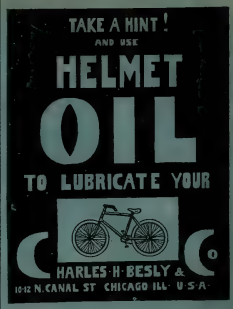
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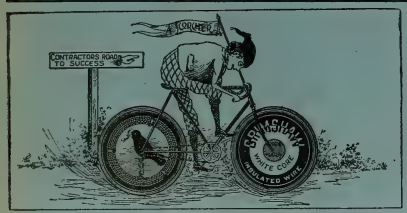


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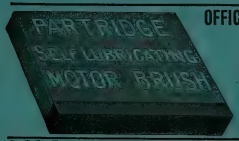


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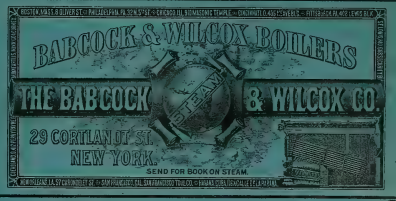

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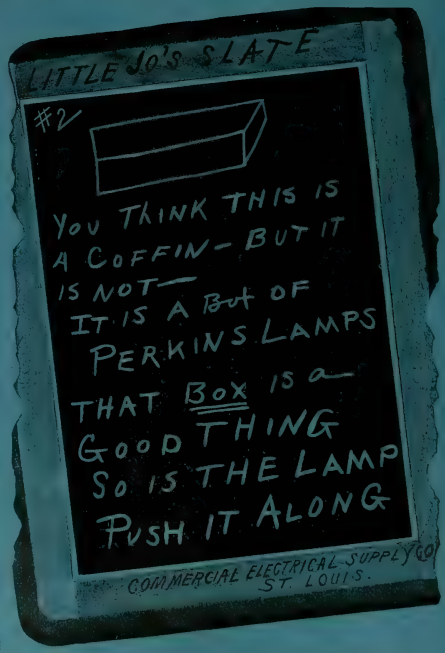


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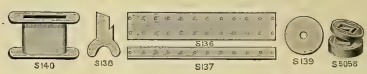


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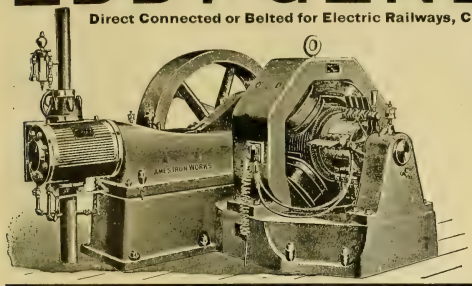

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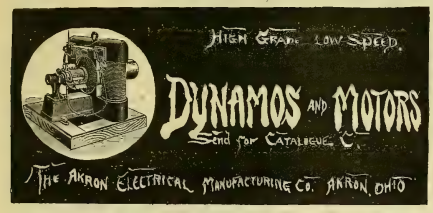

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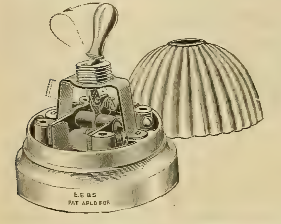


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Nat'l Underground Cable Co.
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Partrick & Carter Co.
Phillips Insulated Wire Co.
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Standard Underground C. Co.

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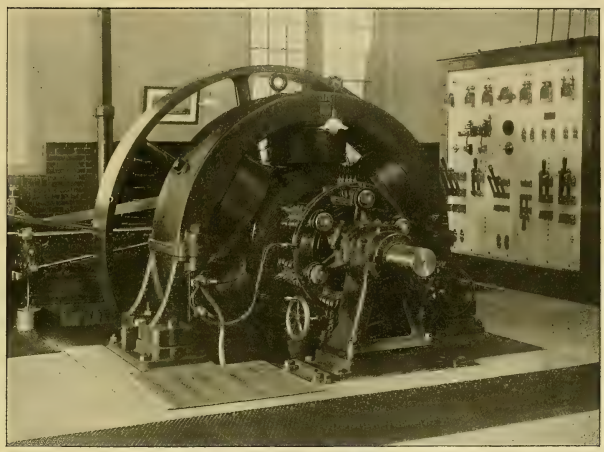
# Western Electric Company
# Electric Lighting Apparatus.



SLOW SPEED GENERATOR.

Arc Lamp for Incandescent Circuit.

SLOW SPEED

## Generators and Motors

WITH IRON-CLAD ARMATURES,

Direct Connected

OR Belt Driven.

*COMPLETE EQUIPMENTS.*

Arc Lamps for Incandescent Circuit.

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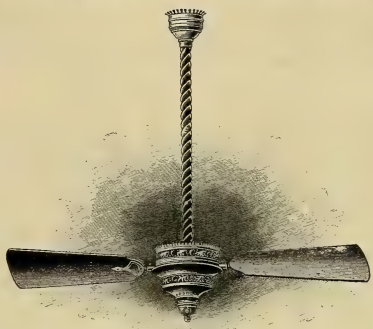
Chicago. New York.

SEASON 1896.

# THE NEW DIEHL ELECTRIC FANS.

HIGHLY FINISHED IN
Japan,
Nickel,
Polished Brass
...AND...
Venetian Designs.



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ELIZABETHPORT, N. J.

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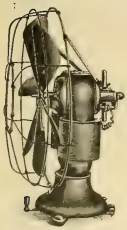
CHICAGO,

Manufacturers of



Fan Motors,
Dynamos
AND
Electric Motors.

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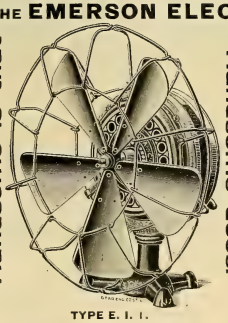
And 112 Liberty St., New York.

"Handsome is that Handsome does."



TYPE E. I. I.

NOTE THIS
Current Consumption:

"Meston" 12-inch fan, 60 to 70 watts.
" 16-inch fan, 70 watts.
Induction 12-inch fan, 7,200 alts., 80 to 90 watts.
Induction 16-inch fan, 7,200 alts., 110 to 125 watts.
Induction 12-inch fan, 10,000 alts. ,90 to 130 watts.

CHEAPEST
Fan Motors on the market because
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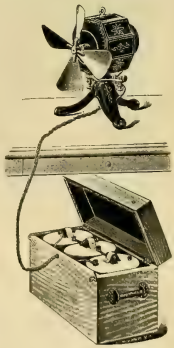

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EDISON MFG. CO.,
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FUSE WIRE AND LINKS FOR ALL SYSTEMS,
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# THIS ALTERNATING CEILING FAN WORKS.

**We Guarantee It.**

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**No Brushes.**

Uses Less Current than any Fan on the Market.

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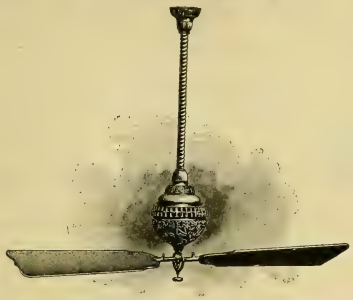

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Air can be thrown UP or DOWN.
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The Handsomest Fan ever offered to the trade.

Fans Finished in Bronze, Nickel and Polished Brass.
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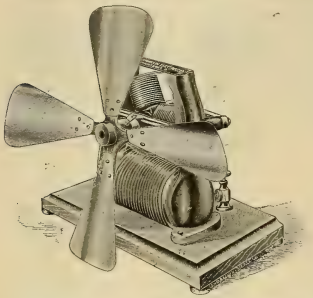

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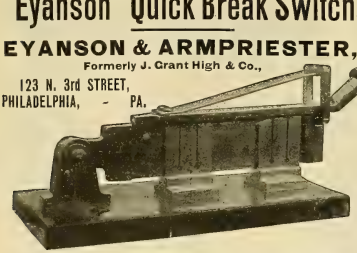

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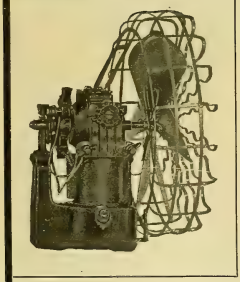

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They will therefore do **BIG WORK** if you want it.

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The complete Fan Outfit may not address itself to your eye as pleasantly, as to design and shape, as some others, it having been considered unwise to sacrifice stability to enhance its appearance.

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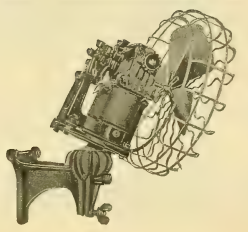

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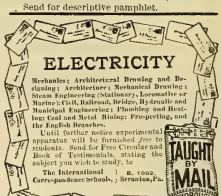


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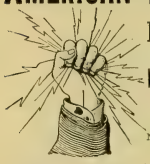

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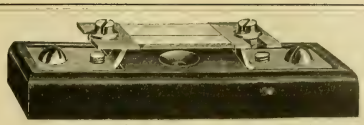

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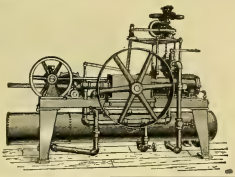
GENTLEMEN:—We have one of your Governors in use at our power house at Millers Falls, Mass., taking care of two water-wheels to perfection, regulating the power *within a few volts.* We took out one Governor and replaced it with a LOMBARD GOVERNOR which gives *perfect satisfaction.* Yours truly, MONTAGUE ST. RY. CO.,
(Signed) H. C. GARFIELD, Supt.



Sold on trial and absolutely guaranteed to hold wheel speed to satisfaction of purchaser, irrespective of sudden changes of load.

Send us a description of your water-wheel plant.

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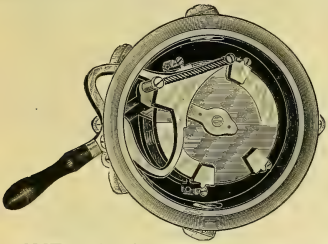

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Water-Tight Iron Case.

Perfect Insulation.

Order one. You will use more.

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Single and Double Pole Iron-Box Fuse Boxes.

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WRITE US. GET OUR DISCOUNTS.

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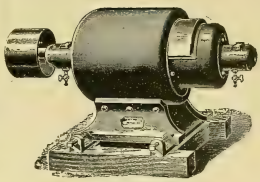

Iron Clad. Completely closed in.

DUST and Moisture proof.

Specially adapted for direct driving machinery.

The application of Motors to machine tools a specialty.

Light weight. Slow and medium speed.

No interior magnetism.

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EXCELS IN

Long Life, Efficiency,
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It is Absolutely Non Freezing,
Labor Saving,
Free from Local Action,
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Superior Generation of Energy.

These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America.
Send for descriptive circular and price list. We guarantee all our Cells.

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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

AGENCIES:
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FACTORY: Pawtucket, R. I.

## WANTED.

A first-class electrician and superintendent. One who understands the management of men and has had practical experience in both. Must have a reputation and best of references. State particulars with price. None but the best need apply. Address "Carroll," care WESTERN ELECTRICIAN, Suite 510 Marquette Bldg., Chicago.

## WANTED.

Situation as superintendent of an electric light plant, or combined electric light and water works plant. Have had considerable experience in both. Have held present position over 4 years and only desire to change on account of my wife's health. Am strictly temperate and can furnish best of references as to character and ability. Address "Water Works," care Western Electrician, 510 Marquette Bldg., Chicago.

## WANTED.

Position by young man having had large practical experience with electric lighting and power machinery, and understands arc light repairing; also experienced in the care of steam plants. Can give good references.

Address "J. V. E.,"
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## CORRESPONDENCE

Is solicited with companies needing the services of a superintendent or manager. Well known references will be named showing an experienced and reliable man. Have successfully operated some of the best plants and will name them as reference. Past record will show that I am thoroughly familiar with repair details and am first-class electrical and mechanical engineer. "Satisfaction," care WESTERN ELECTRICIAN, Suite 510 Marquette Bldg., Chicago.

## WANTED.

One 30 light and 40 light armature core for Standard Electric Co.'s arc dynamo. State condition and lowest cash price.

CHICAGO ARMATURE CO.,
197 So. Canal St., CHICAGO.

## FOR SALE.

| MOTORS. | DYNAMOS. |
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| One 1 horse power. | One 35 H. 16 c. p. dynamo. |
| Two 3 horse power. | One 65 H. 16 c. p. dynamo. |
| One 5 horse power. | One 100 H. 16 c. p. dynamo. |
| Two 7½ horse power. | One 135 H. 16 c. p. dynamo. |
| One 10 horse power. | One 60 k. w. alternator; one 30 k. w. D. C. compound wound generator. Machines all new. Address Y. J. MAYO, 100 N. Clinton St., Chicago. |

## FOR SALE.

One 1,000 light Ancand scent dynamo and one 100 light incandescent. Both direct current, compound wound.

L. A. HINE & CO.,
234 E. Lake Street,
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## FOR SALE.

Three 500 light Thomson-Houston 110 volt dynamos with belts and instruments complete, and one 100 h. p. Ideal engine in good order. For sale at a bargain if taken at once. They are now being replaced by three 1,000 light National dynamos and three 100 h. p. Ideal engines.

A. L. IDE & SON,
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## FOR SALE.

A 1,200-light Fort Wayne Alternating Incandescent dynamo, with Exciter. Second-hand, but in perfect order. Address

THE S. FREEMAN & SONS MFG. CO.,
Racine, Wis.

$575!
FOR SALE!
New 50 Light
2,000 Candle Power
Arc Dynamo.
Complete with
Usual accessories.
Manufactured by
Standard Electric Co.
This machine is
New, not second hand.
But advertiser has
No use for it and
It will be sold for
$575 cash.
Address CASH,
WESTERN ELECTRICIAN
Office.

## FOR SALE.

One 200-drop Line Telephone Switch board, good as new, elegantly made of cherry, on table form. Cash $250.00.

PEOPLE'S TELEPHONE CO.,
KNOXVILLE, TENN.

## PROPOSALS.

Sealed proposals will be received by the West Chicago Park Commissioners, at their office in Union Park, until 4 o'clock p. m. of Tuesday, May 12th, 1896, for furnishing and installing the following apparatus and machinery comprising the Arc Light Plant to be located in Garfield Park:

Sec. "A"—500 H. P. Water Tube boilers in two units.

Sec. "B"—Automatic Stoker and Furnace for same.

Sec. "C"—Coal and Ash Conveyors and Storage Bins.

Sec. "D"—Condensers and Pumps.

Sec. "E"—Open Heaters and Steam Separators.

Sec. "F"—650 H. P. Cross Compound Corliss Steam Engine.

Sec. "G"—Jack-Shaft, Clutch-Pulleys and Rope-Drive.

Sec. "H"—7 125 Light Arc Dynamos or 6 150 Light Arc Dynamos.

Sec. "I"—750 Series, Double-service, 2,000 C. P. Arc Lamps.

Sec. "J"—300,000 feet Underground Cable, 30,000 feet Rubber Covered Wire.

Sec. "K"—Marble Switchboard.

Sec. "L"—Masonry for Foundations, etc.

Sec. "M"—Two-ton Pulley Block and Crane.

In accordance with plans and specifications on file in the office of Mr. Foree Bain, electrical and mechanical engineer, Monadnock Block, Chicago, Ill., a copy of said plans and specifications being also on file in the office of the Engineer of said Park Commissioners in Union Park.

Bidders may figure on the work under each section, or as many sections of the specifications as herein named as they may desire. Contracts will be awarded under each section separately.

The time specified for completion of the work under the several sections varies from 90 to 120 days, from the notice to proceed, and the contractor will be required to furnish a bond from a surety company doing business in the City of Chicago and acceptable to the West Chicago Park Commissioners, in the sum equal to one-half the value of the contract price, guaranteeing the faithful performance of the contract in accordance with the specifications and within the time specified. He will also be required to furnish a similar bond to the satisfaction of the Commissioners, guaranteeing them against any damage done to any Park property or any damage that may result from accident to any person or thing through the operation of this contractor in the performance of his contract, and also guaranteeing the Commissioners against any liability, damage or loss through any patent suits for royalties or any litigation that may arise from the use of any device, machinery or apparatus that may be furnished by the said contractor.

The proposals must be made out upon blank forms contained in each section of the specifications, which must be filled out by the contractor, thus completing his proposal. Any portion that can not be guaranteed by the contractor must be plainly erased before being submitted as a guaranteed proposal.

Proposals must be sealed and addressed to the West Chicago Park Commissioners, and endorsed on the envelope in the wording heading each specification, for instance: Proposals to furnish boilers must be endorsed "Boilers, Section A;" to furnish boilers and engines must be endorsed "Boilers and Engines, Sections A and F."

The proposals must be accompanied with 5 per cent. of the amount of the bid, which must be in currency or a certified check, drawn on a responsible bank doing business in the City of Chicago and made payable to the West Chicago Park Commissioners.

No proposals will be considered unless the terms of the specification in regard to submitting proposals have been strictly complied with, and the parties tendering it shall furnish evidence satisfactory to the commissioners of his or their ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract should it be awarded.

The West Chicago Park Commissioners reserve the right to reject any and all bids.

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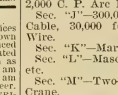

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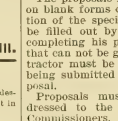

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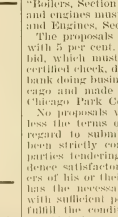

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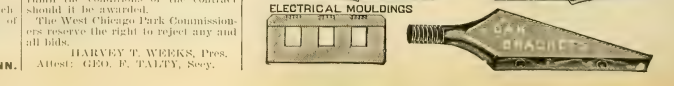
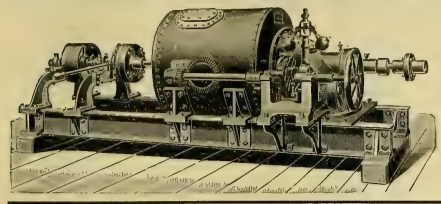


# Victor Turbine Water Wheel.



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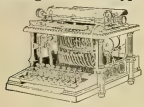

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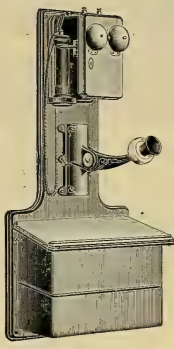

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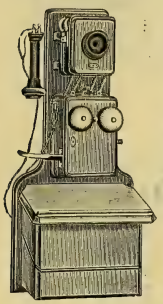

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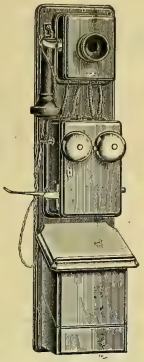

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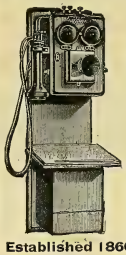

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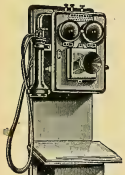

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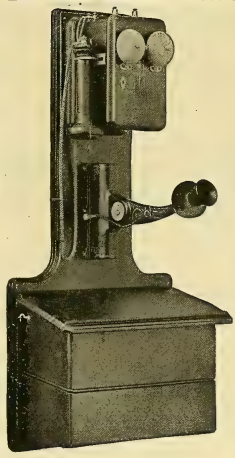

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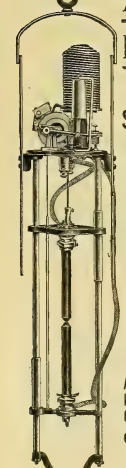

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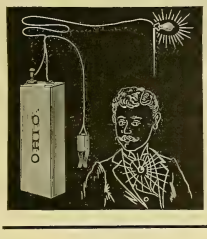


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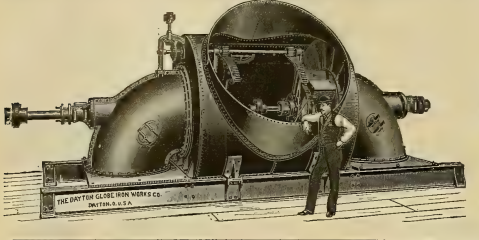


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| ¾ " | 16.42 | 122.00 | 127.18 | 193.19 | 82.58 |
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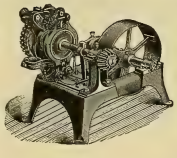

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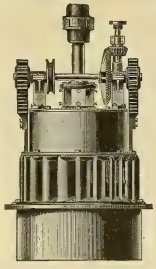

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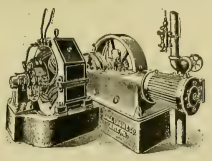

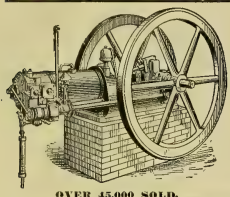

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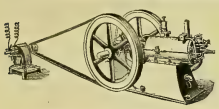

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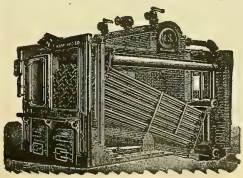

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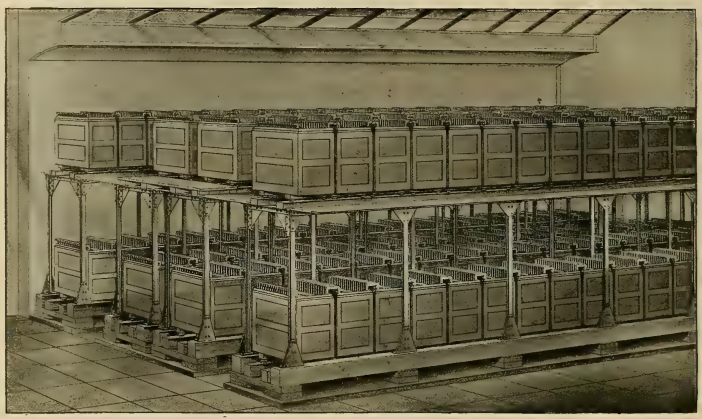

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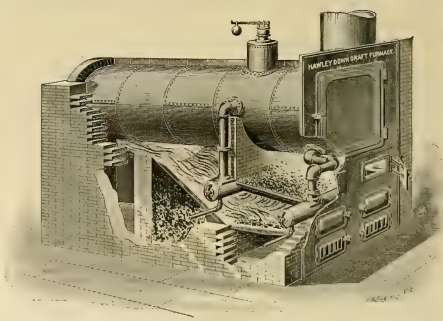


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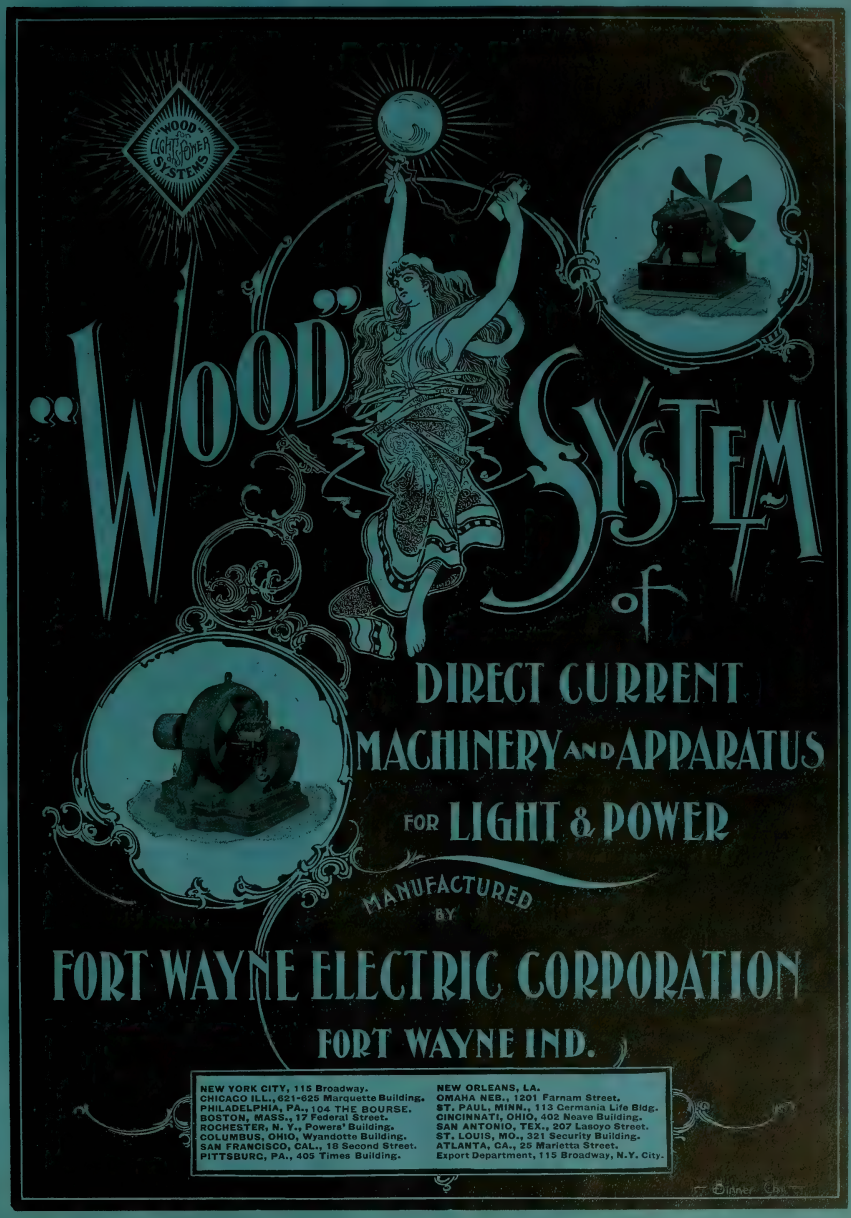
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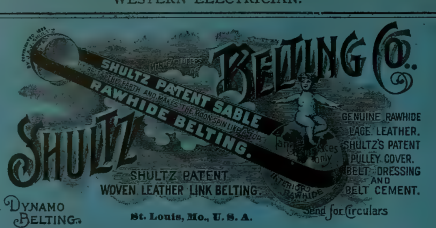
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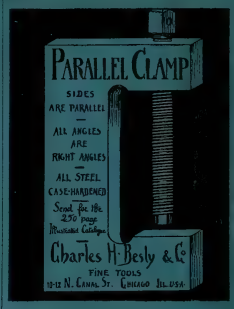
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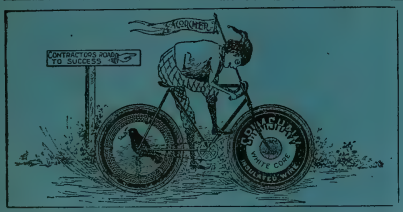


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Vol. XVIII. CHICAGO, MAY 9, 1896. No. 19



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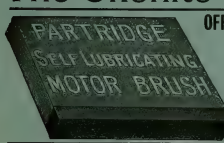


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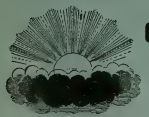

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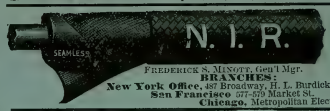


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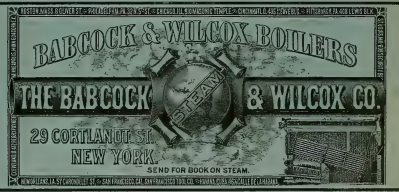


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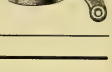

We claim a great deal for the "Medbery," but the single fact that all we claim is carried out to the letter is what makes it the "standard" for superior and economical equipment.

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**Cored and Solid for Direct Lighting.**

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THE BEST ON THE MARKET.

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## NEW ERA IN ELECTRIC ADVERTISING.

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**Ask your NEAREST SUPPLY HOUSE for Sample or write**

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**High Grade Incandescent Lamps,**

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Strong and Light,
Highest Grade Workmanship and Material.

**Moulded Mica Insulation.** **Vulcabeston** Controller Parts, etc.

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No. 900

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No. 905.

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Generators for Power Transmission or Isolated Lighting.
CARD Generators are all Multipolar and Slow Speed.

AGENTS WANTED IN UNOCCUPIED TERRITORY.

75 K. W. GENERATOR.

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Multipolar Slow Speed Stationary Motors.
Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

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## INCANDESCENT LAMPS

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

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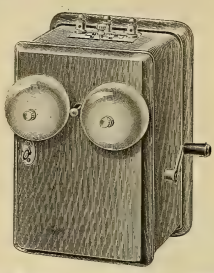
IT NEVER DISAPPOINTS

To THE VICTORS BELONG THE SPOILS

Central Electric Company
CHICAGO

**NO. 7707**
**Iron Box Bell.**

Ask your dealer for the No. 7707 Iron Box Bell.



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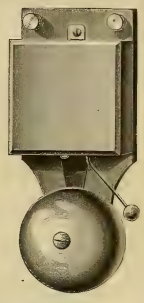
We sell Magneto parts separately.
. . . Quotations on application.



**STANDARD**
**Wood Box Bell.**

Kindly refer to this paper when writing.

# H. E. & C. BAXTER,

MANUFACTURERS ELECTRICAL SUPPLIES,

**BEDFORD, DIVISION AND CANTON STREETS, BROOKLYN, N. Y.**

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We have gotten out and are ready to place on the market a new form of these already well-known instruments in which all the valuable features of the old are retained. The new instruments are dead beat, enclosed in a dust-proof iron case, simple in design, most carefully made and guaranteed to high degree of accuracy. Descriptive circular and price list on application. . . . . .

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Can be used for a very wide range of resistance measurements. It is accurate, easily portable, self contained and easily used. Send for circular No. 34, in which will be found a complete description of the set with all necessary instructions for its use. . . . . .

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*Manufacturers and Importers of and Dealers in*

## Scientific Instruments of All Kinds,

*1010 Chestnut St., = PHILADELPHIA.*

New York Office, 116 Fulton Street.

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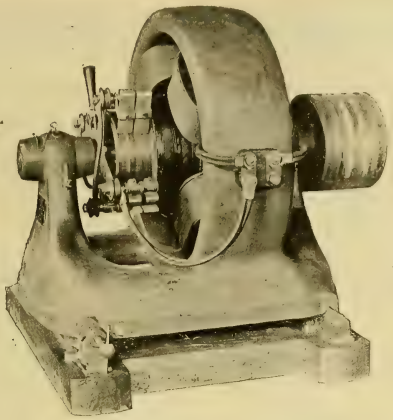
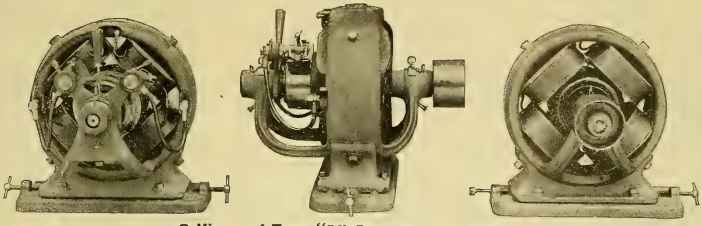


# THAT WILL COMPETE WITH ANYTHING ON MARKET.

Type "C" Solid Yoke 22 K. W. Generator.



3 Views of Type "D" Dynamos and Motors.

**NO. 1**

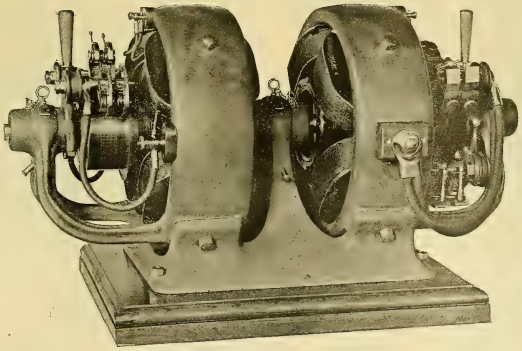
Circular describes our small Dynamos and Motors . . . . . .

**NO. 2**

describes Machines from 5 H. P. to 27 H. P. .

**NO. 3**

describes Machines from 30 H. P. up . . . .



Type "D" Motor Generator.

**Special Illustrated Descriptive Circulars sent on application...**

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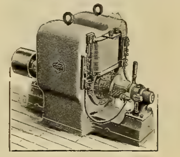
LAFAYETTE ENGINEERING & ELECTRIC WORKS,

MAKERS OF HIGH GRADE

DYNAMOS

AND

MOTORS.



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Electric Storage Battery Co.
Ohio Storage Battery Co.
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Chicago Gen'l Fixture Co.
Electric Appliance Co.
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Edwards & Co.
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
National Electric Co.
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Western Electric Co.
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Channon Co., H.
Chicago Belting Co.
Jewell Belting Co.
Rhoads & Sons, J. E.
Shultz Belting Co.
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Abendroth & Root Mfg. Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
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Freeman & Sons Mfg. Co.
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Holmes Fibre-Graphite Co.
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Solar Carbon & Mfg. Co
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Western Electric Co
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General Electric Co
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Reisinger, Hugo.
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National Electric Co.
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Interior Conduit & Ins. Co.
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General Electric Co.
Interior Conduit & Ins. Co.
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Walker Co.
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Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
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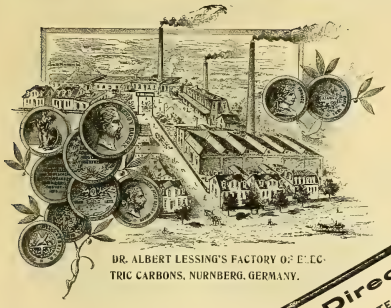

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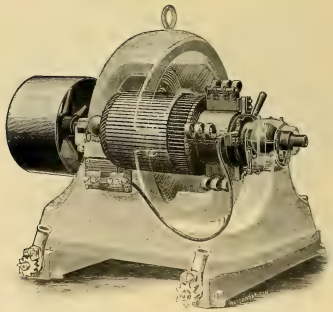

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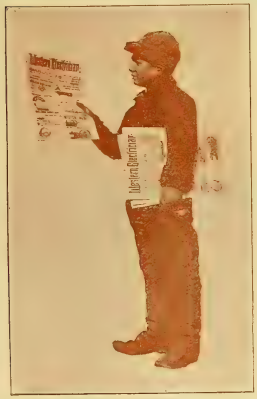


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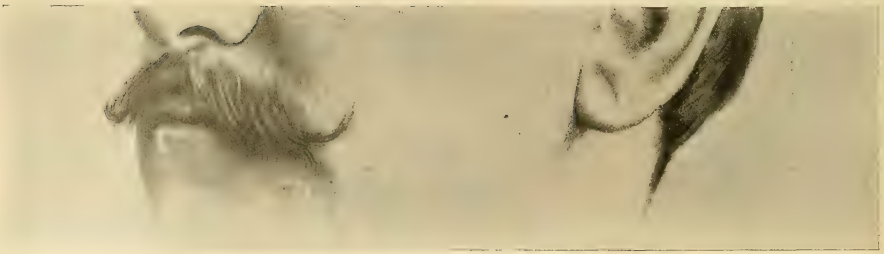

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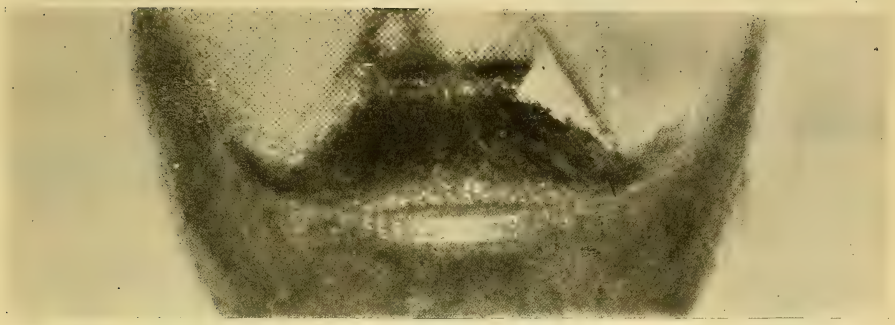

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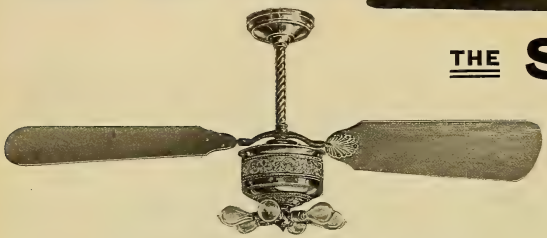

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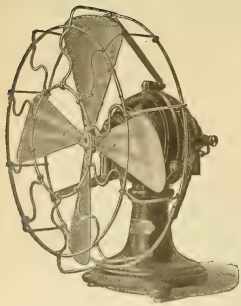

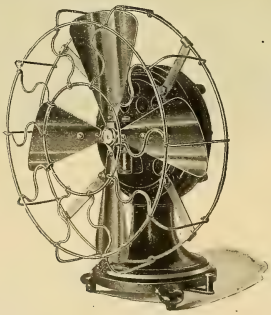

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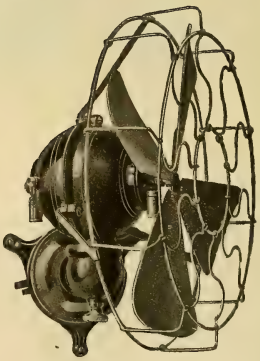

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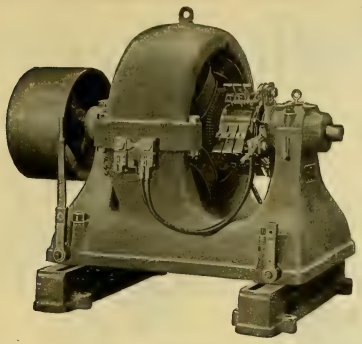

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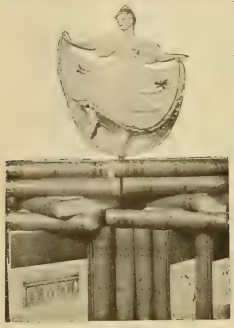

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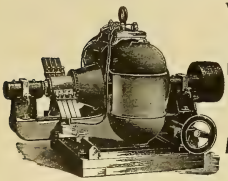

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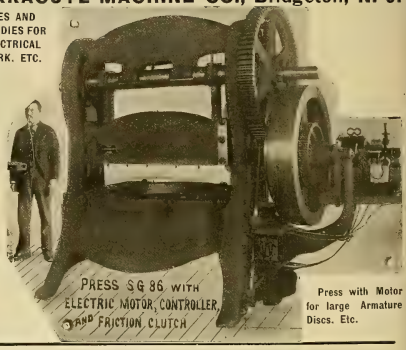


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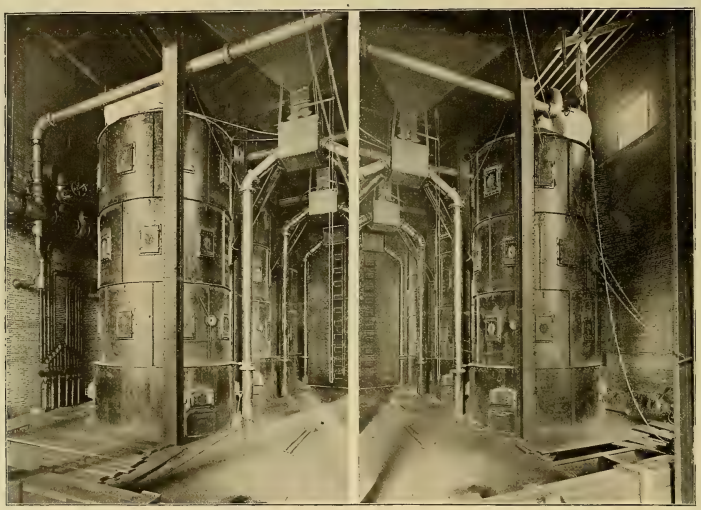

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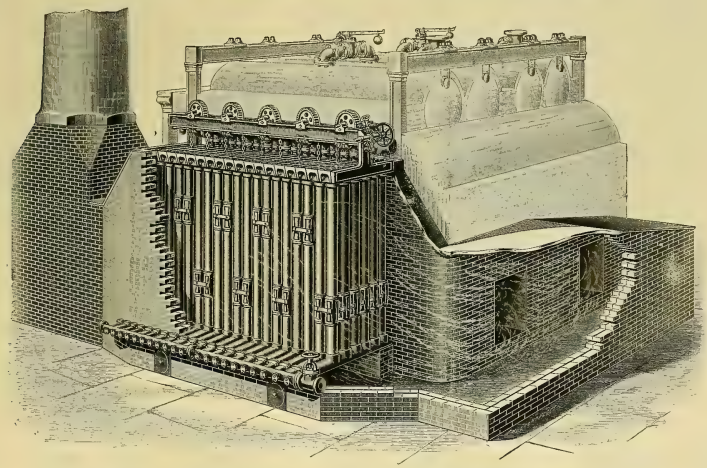

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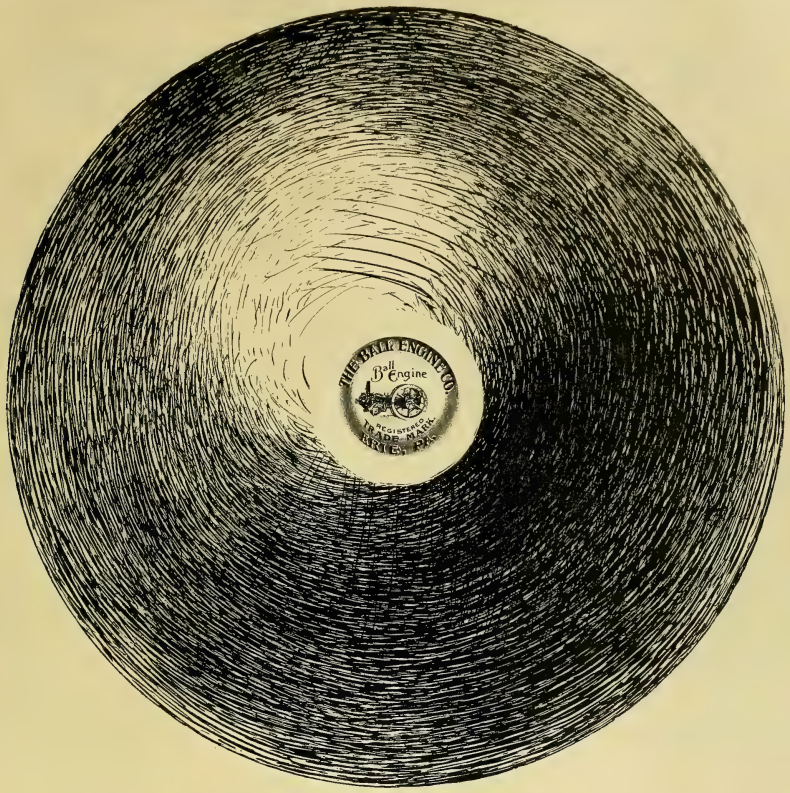


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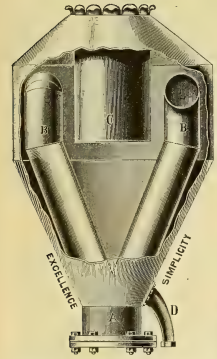


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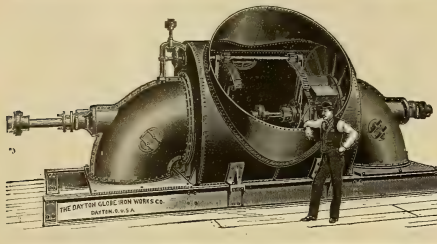


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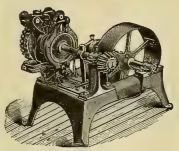

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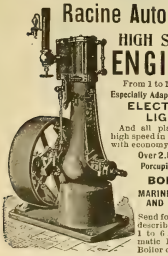

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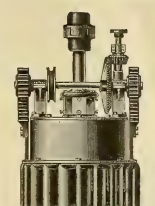

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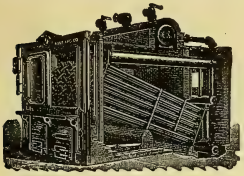

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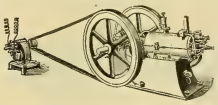

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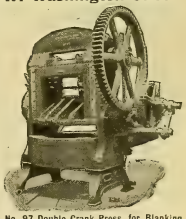

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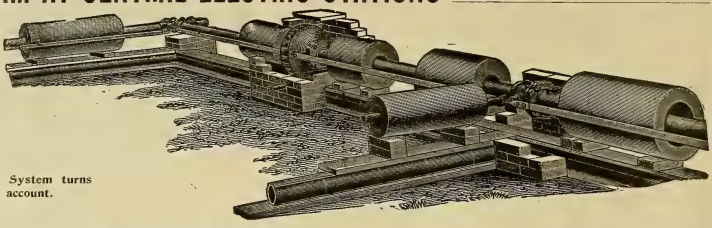

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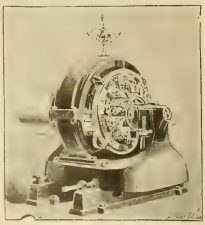

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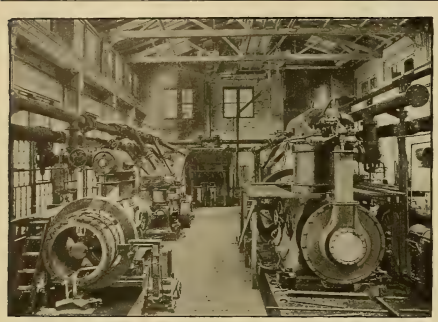

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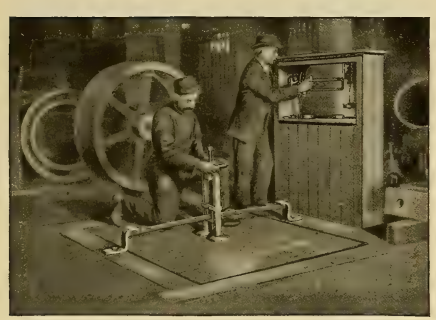

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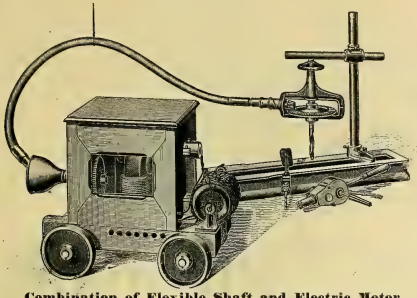


**Combination of Flexible Shaft and Electric Motor.**

We are the Inventors of the Flexible Shaft.

WE ARE THE

## Oldest and Largest Manufacturers

OF

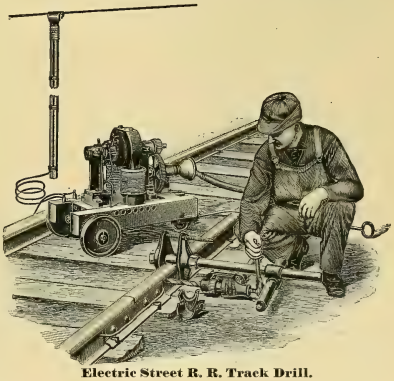
Flexible Shafts in the World.

The distance at which our

## Electrical Drilling Plant

Can be used from the source of power is only limited by the length of insulated wire in use.

Our Electrical Street Railway Track Drill can be attached anywhere to a trolley wire in a moment and is ready for work. Our new Track and Corner Drill Press will do the rest.



**Electric Street R. R. Track Drill.**

## SOME SHOPS ARE BEST SUITED TO ROPE TRANSMISSION,

**But if you have a large range of work and an electric current, consider the combination of Flexible Shaft and Electric Motor. Write us for catalogue and price list.**

# STOW MANUFACTURING CO.

**BINGHAMTON, N. Y.**

# LOOK AT EXTENSIVE ... EXHIBIT.

## SEASON 1896.

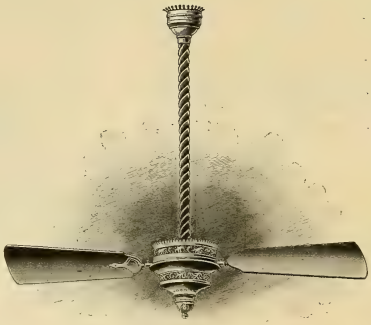
## THE NEW DIEHL ELECTRIC FANS.

★ ★ ★

Highly Finished in

Japan,
Nickel,
Polished Brass
AND...
Venetian Designs.

★ ★ ★



★ ★ ★

INCREASED EFFICIENCY.
IMPROVED MECHANICAL CONSTRUCTION.

★ ★ ★

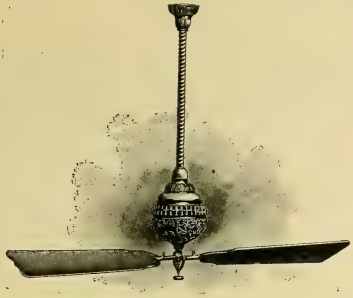
FOR CATALOGUES AND PRICE LISTS ADDRESS

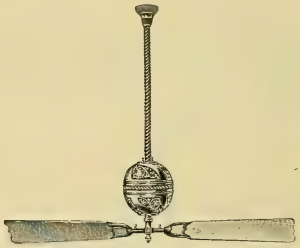
# DIEHL & COMPANY,

SHOW ROOMS: 561-563 Broadway, New York City.
128-138 Essex Street, Boston.

ELIZABETHPORT, N. J.

# This Alternating Ceiling Fan Works.



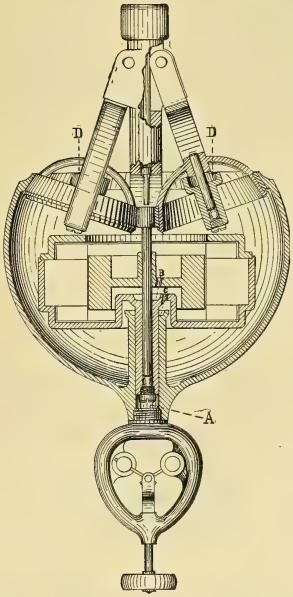


THE HANDSOMEST FAN EVER OFFERED TO THE TRADE.

**We Guarantee It.**
**No Commutator.**
**No Brushes.**

**Uses Less Current than any Fan on the market.**

**Our Direct Current Fan Works.**




## OUR GUARANTEE IS GOOD.

Only Fan having Blade Adjuster.
Air can be thrown up or down.
All bearings self-oiling.

**Ask for New Catalogue**
And Discounts, and you will send us an order.

Fans finished in Bronze, Nickel and Polished Brass.
We manufacture a full line of BELT FANS and WATER MOTORS.

**Agents Wanted in Leading Cities.**

# TUERK WATER METER CO.,

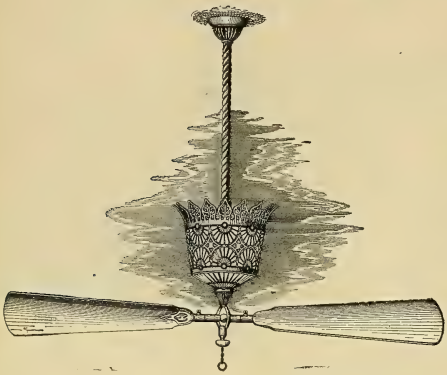
**FULTON, N. Y.**

E. B. LATHAM & CO., AGENTS, 136 LIBERTY STREET, NEW YORK.

# Western Electric Company,

## New York, Chicago.

# Ariel Alternating Current Fan Motor.



**It is** strong, durable, highly efficient, handsome, noiseless.

**It has** no commutator. No winding on the armature. No chance to burn out. A blade shifter changing the angle of the blades without stopping.

**It runs 125** revolutions per minute.

**The motors** are of the well-known induction type.

**The bearings** are self-oiling, chambers once filled containing enough oil to last an entire season.

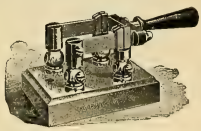
**Made for** alternating currents of **50** or **100** volts, **7,200, 14,000** to **16,000** alternations per minute.

ALSO

## Crescent Desk and Ceiling Fans, Meston Alternating Current Desk Fans, Lundell Desk Fans, Globe Desk Fans.

**FAN MOTOR SHEET NO. 210 NOW READY.**

BRYANT SOCKETS,
P. & S. TUBES,
INTERIOR CONDUIT
INSULATED WIRE,
LAMP CORD.



HILL STATION SWITCHES,
WESTON INSTRUMENTS,
SWITCHES, ALL KINDS,
AT LOWEST PRICES.

# WESTERN ELECTRIC CO.

NEW YORK,
Thames and Greenwich Streets.

CHICAGO,
227-275 S. Clinton St.,
242-258 S. Jefferson St.,
37-45 W. Congress St.

London, Antwerp, Berlin, Paris.

# SPRAGUE

# Electric Elevator Company,

## Postal Telegraph Building, New York City,

....BUILDERS OF....

# Electric Passenger AND Freight Elevators.

● ● ● ●

## The Multiple Sheave Screw Machine

Duplicates Hydraulic Service with less than half the water evaporation and coal expenditure. . .

IT HAS ANY REQUIRED SPEED AND CAPACITY.
EACH MACHINE IS AN INDEPENDENT UNIT.
LIKE PARTS ARE INTERCHANGEABLE.
IT HAS A SUPERIOR DOWN START.
IT OCCUPIES LESS SPACE.
IT IS ABSOLUTELY SAFE.

## The Worm Gear Drum Machine

is for all classes of intermediate service. It is the most perfect machine of its type built. . .

## The Automatic House Elevator

is absolutely safe. It requires no operator. . .

● ● ● ●

### Among typical buildings adopting Sprague Machines are:

Postal Telegraph Building, New York City; Parrott Building, San Francisco; Board of Trade, Chicago; Guaranty Building, Buffalo; Syndicate Building, New York City; Union Trust Building, Detroit; Gerken Building, New York City; Custom House, New York City; Merchants' National Bank, Baltimore; Hotel Walton, Philadelphia; J. T. Williams Office Buildings, New York City; Mabley Building, Detroit; Young Men's Christian Association, New York; Daniells' Stores, New York; Court House and City Hall, Minneapolis; Boston Daily Globe, Boston; Safe Deposit Building, San Francisco; Academy of Music, San Francisco; Canada Life Insurance Co., Montreal; State Mutual Life Assurance Co., Worcester; Johns Hopkins University, Baltimore; Edison Electric Illuminating Co., New York; Currier Bank Building, Los Angeles; Ahrens Building, New York; Wadsworth Building, New York; The Callender, McAuslan & Troup Company's Department Stores, Providence; the residences of Mr. John Jacob Astor and Mr. George Morgan, New York; City and County Court House, Salt Lake City; Graham Building, New York City; Mutual Benefit Insurance Co., Boston; Government Printing Office, War Department, Washington; Wilcox Building, Los Angeles.

Recent contracts include four of the finest and most costly buildings of their respective classes ever projected:

**Manhattan Hotel, 9 Elevators.**

**Siegel-Cooper Stores, 21 Elevators.**

**Commercial Cable Building, 21 Stories.**

**Mr. John Jacob Astor's New Palatial Hotel, 19 Elevators.**

# KERITE

MEANS

## PERFECT INSULATION.

THE ONLY RUBBER INSULATION RECEIVING MEDALS OF AWARD AT WORLD'S FAIR, 1893.

Aerial, Underground and Submarine Electric Wires and Cables

FOR

Telephone,
Telegraph,
Light and Power.

LEAD ENCASING IN ALL ITS BRANCHES.

Kerite Tapes.

W. R. BRIXEY, Manufacturer, SEYMOUR, CONN.

J. E. HAM, General Agent, 203 BROADWAY, NEW YORK.

S. F. B. MORSE, Chicago, Ill.

NEW ORLEANS ELECTRIC CO., New Orleans, La.

KENNEDY & DU PEROW, Washington, D. C.

CALIFORNIA ELECTRICAL WORKS, San Francisco, Cal.

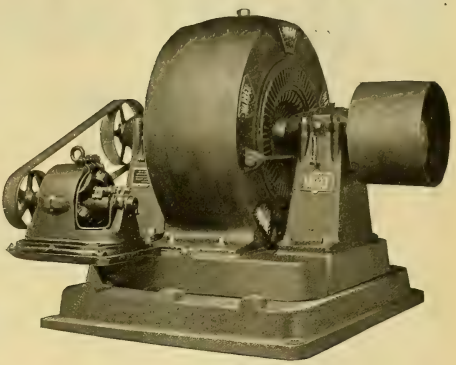
# The Warren Alternator.

**Induction Type** | Without Moving Wires. Without Collector Rings. Without Brushes.

**Any Voltage** 110 / 220 / 440 Volts without 1,000 / 2,000 / 5,000 Volts with **Transformers.**

Stationary Single Ring Armature—Stationary Field Coil.

Revolvable Part a Solid Cylinder of Steel.



**EFFICIENCY THE HIGHEST** } Of any Alternating Current Generator known.
**REGULATION THE CLOSEST** }

NOISELESS IN OPERATION.

BUILT TO EARN MONEY WITH—NOT TO SPEND MONEY UPON.

## Warren Electric Co., Chicago.

**SALES AGENTS:**

**Wendell & McDuffie,** 126 Cortlandt St., New York.
**Bates Machine Co.,** 154 Congress St., Boston, Mass.
**A. M. Searles,** 181 Dearborn St., Chicago.
**California Electrical Works,** San Francisco, Cal.

## There Are Many Switches

In the market, but there are none to compare with the New England.

## AT THE CONVENTION

You will not find a special exhibit of them, but you will find them in use everywhere, and in stock with all the leading dealers in New York City. They are made for service and economy, and are equaled by none.

This switch was first made nearly

**EIGHT YEARS AGO,**

and while others have been trying to make something "just as good"

## THE NEW ENGLAND SWITCH

has stood right up to the mark and done its work day after day in the face of the most bitter opposition in many cases.

Does not this recommend them to you as being the

**BEST SWITCH KNOWN TO-DAY?**

If not, you should pay us a visit at our factory and be convinced for yourself, by the amount of work we are daily turning out in our enlarged sphere as The O. S. Platt Mfg. Co. (incorporated Feb. 18, 1896). We have very greatly increased our facilities, as the market demands a larger production, so that now we are prepared to furnish our customers with the three essential attributes to success embodied in the make-up and delivery of goods, namely:

**QUALITY--QUANTITY--QUICKNESS.**

## O. S. PLATT MFG. CO., 88-102 Cannon St., Bridgeport, Conn.

# WIRES AND CABLES

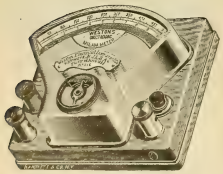
OKONITE
TRADE MARK.

**When insulated with Okonite are extremely efficient and long-lived. They will not crack, and effectually resist the decomposing influence of the elements. Catalogue?**

## THE OKONITE COMPANY, Ltd.,

Postal Telegraph Building, 253 BROADWAY, **NEW YORK.**

# Weston Standard Portable Direct-Reading



Weston Standard Portable Direct Reading Voltmeter.

**Voltmeters, Ammeters, Millivoltmeters, Voltammeters, Milliammeters, Ground Detectors and Circuit Testers, Ohmmeters, Portable Galvanometers.**

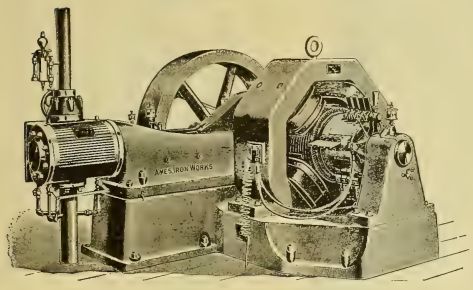
Illuminated Dial Station Voltmeter.

Our Portable Instruments are recognized as **The Standard** the world over. The **Semi-Portable Laboratory Standards** are still better. Our **Station Voltmeters and Ammeters** are unsurpassed in point of extreme accuracy and lowest consumption of energy.

## Weston Electrical Instrument Co.,

114-120 William Street, Newark, N. J., U. S. A.

# Eddy Generators



DIRECT CONNECTED OR BELTED

FOR

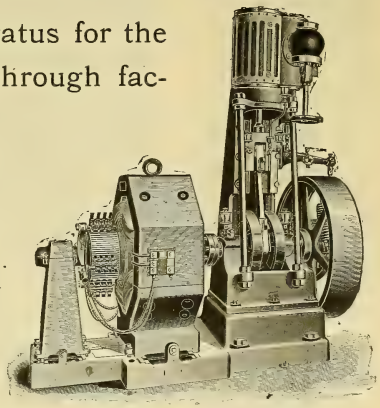
ELECTRIC RAILWAYS,
CENTRAL STATIONS,
ISOLATED LIGHTING

OR

POWER PLANTS.

## EDDY MOTORS—SLOW, MEDIUM OR HIGH SPEED.

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.



All Our Apparatus Guaranteed As Represented.

## The Eddy Electric Manufacturing Company,

**WINDSOR, CONN.**

New York, H. B. Coho & Co., Mail and Express Building.
Philadelphia, Walter C. McIntire & Co., 506 Commerce St.
Boston, G. M. Angier & Co., 64 Federal St.
Elmira, S. N. Blake.
St. Louis, Western Electrical Supply Co.
Kansas City, W. T. Osborn.

**Western Office: 305 Dearborn St., Chicago, Wallace & Hine, Western Agents.**

When at the Exhibition don't forget to look for our exhibit of

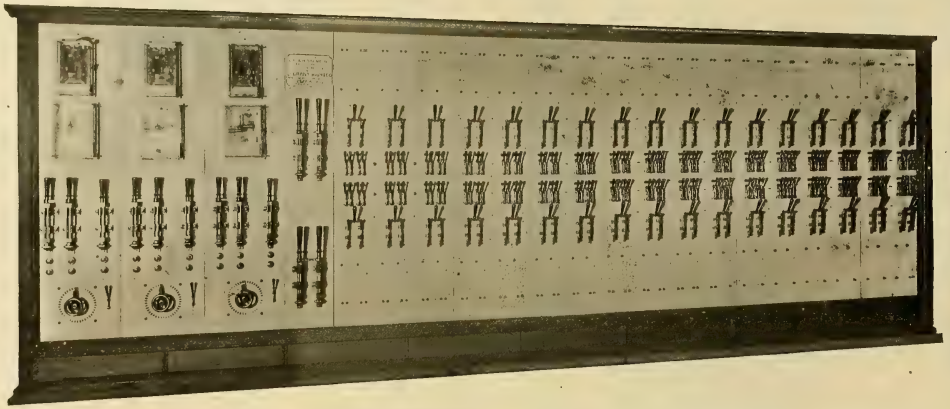
# SWITCH-BOARDS!

Switches,

SWITCH-BOARDS
For Power and Lighting.

SWITCHES,
From 25 amp. to 10,000 amp.

Main Line Fuse Blocks, Etc.



Switches,

Bus-Bar Connectors,
Switch-Board Fillings,
Special Switches
For all Purposes.
Cable Terminals.
Tablet Boards.

6,000 Ampere Board erected at the Warden Tenement Mill Building in Philadelphia by us, length of board 36 feet, containing 252 square feet of White Italian Marble

# EYANSON & ARMPRIESTER,

FORMERLY J. GRANT HIGH & CO.,

**BRANCH OFFICES:**

Chicago, Ill., Metropolitan Electric Co.
Louisville, Ky., Jas. Clark, Jr. & Co., 315 W. Main St.
New Orleans, Widmer & Spranley, 608 Custom House St.
New York, Chapin & Douglass, 136 Liberty St.

MAIN OFFICE AND WORKS:

**123 N. 3rd ST., PHILADELPHIA.**

# WHEN YOU BUY

M. C. Station Arrester.

## Garton Lightning Arresters,

You buy the Best!
Don't forget that!

That's why their use is increasing so rapidly that we are forced to work overtime to fill orders promptly. Garton Arresters are made for use on any circuit of any voltage, either direct or alternating current.

**"THEY LAST FOREVER."**

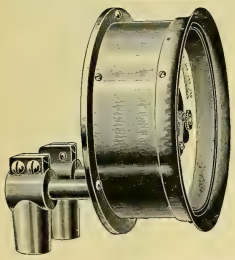
St. Ry. Station Arrester.

No High Ohmic Resistance to break down after a few discharges!
No Charred Streaks, but ample Carrying Capacity!
No Pivots or Hinges to blister or stick! No Fuses to replace! No Light Copper Balls to melt!
No Inductive Resistance in the discharge path! No Attention Required, are always ready!

Write for Prices, or any Information, to your Supply Dealer, or to

## GARTON-DANIELS ELECTRIC CO.,

*KEOKUK, IOWA, U. S. A.*



PEER OF ALL

# COMMERCIAL INSTRUMENTS.

Suitable for Isolated Plants and Feeder Circuits in Power Plants.
Unsurpassed in appearance and workmanship. . . . . .

**Get New Circular and New Price List. Then you will order.**

**....AGENTS WANTED IN LEADING CITIES....**

The handsomest tested instrument, and for less money, than you can purchase in this country.

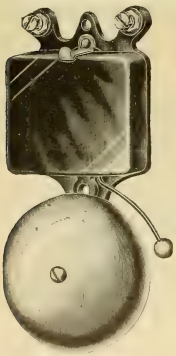
# C. E. NORTON, Manchester, Conn.

# AJAX ARRESTER.

## Minimum Discharge Gap. Maximum Protection.

WRITE FOR NEW PRICE LIST.

**C. S. VAN NUIS,** 43 Cortlandt St., ....NEW YORK.



Styles L. R. H.

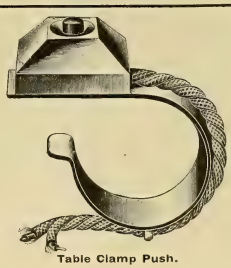
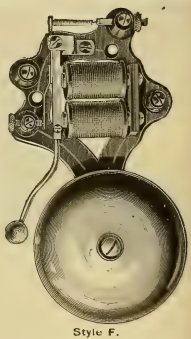


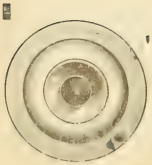
Table Clamp Push.



Style F.

If you want **BELLS** that RING,
If you want **PUSHES** that PRESS,
If you want **SWITCHES** that CONNECT,
If you want **TABLE CLAMPS** that HOLD,
...OR...
If you want **ANYTHING RELIABLE** in this line, see or write

HUEBEL & MANGER,
MANUFACTURERS IN
ELECTRICAL AND
ANNUNCIATORS, BELLS, BRONZE PUSHES, &c. BRASS GOODS
286-290 GRAHAM ST.
BROOKLYN, N.Y.



No. 70.

Style C.

POLES
GREEN BAY WIS
YARDS
CLARE MICH
WAUKESHA WIS
THE VALENTINE-CLARK Company CHICAGO
804-805 GAFF BUILDING
230-236 LA SALLE STREET.

POLES
GREEN BAY WIS
YARDS
CLARE MICH
WAUKESHA WIS
THE VALENTINE-CLARK Company CHICAGO
804-805 GAFF BUILDING
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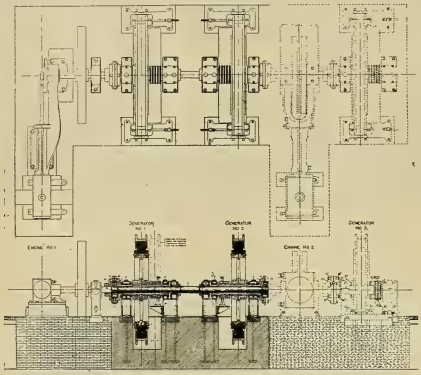
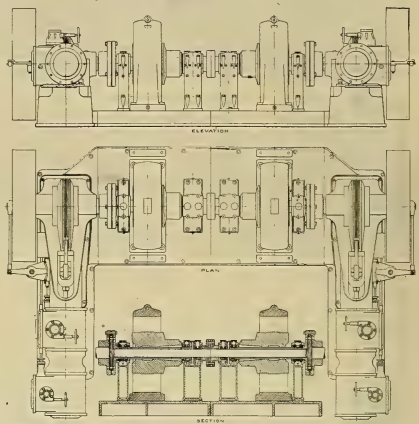
THE VALENTINE-CLARK Company CHICAGO
804-805 GAFF BUILDING
230-236 LA SALLE STREET.

# "Arnold System."

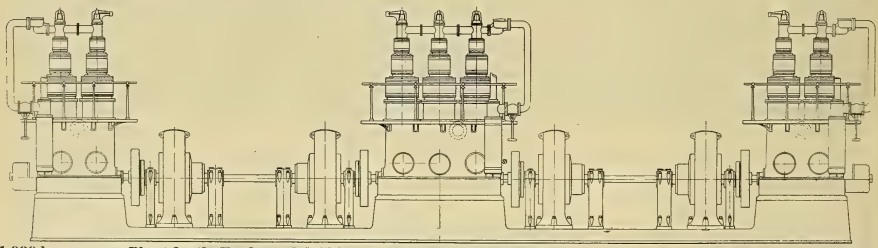
## Less First Cost, Less Real Estate Required, Lower Operating Expenses, Greater Reliability.



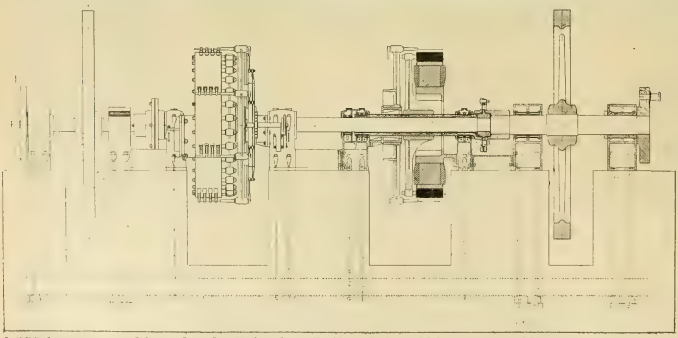
**500 horse power Plant of Ft. Dodge Light & Power Co., Ft. Dodge, Ia. In successful operation since July 1, 1895. Nordberg Corliss Engines, General Electric Monocyclic Generators, 120 revolutions per minute.**



**300 horse power Plant for Chicago Board of Trade. Ames Engines, Westinghouse Generators, 275 revolutions. Now under construction.**



**1,000 horse power Plant for the Englewood & Chicago Electric Railway Co. Willans Engines, Walker Generators, speed 380 revolutions. Now under construction.**



**1,000 horse power Plant for the Suburban Railroad Co., Chicago. Providence Green Engines, Siemens & Halske Generators, 100 revolutions. Now under construction.**

This company owns U. S. patents issued to B. J. Arnold for "Improvements in Electric Power Station Construction," one claim of which reads as follows: "The combination of a series of dynamo electric machines, with a main driving shaft and rotating parts for each dynamo electric machine supported on a hollow sleeve surrounding the main shaft and journaled in independent bearings, with clutch mechanisms (positive, friction or magnetic), whereby such rotating part or sleeve may be positively connected to the shaft at will."

We are prepared to build electric power stations complete, using any make of engines, generators or boilers desired by the purchaser, and give greater reliability in operation for less first cost than is possible with independent direct-coupled units.

# ARNOLD ELECTRIC POWER STATION CO.,

SUITE 1540
Marquette Building,
CHICAGO.

# WE WANT MORE GOOD AGENCIES.

## THREE LETTERS TO THE ELECTRICAL PUBLIC:

# P. E. C.

FIRST.

**To Our Dear Friends, the Manufacturers:**

*Gentlemen:* We are Western Electrical Supply hustlers, having only time enough to handle the best articles made for the purpose intended.

Experience has taught us that central-station men are past the age of experimenting.

Have you got a good article? Do you want it properly placed before interested parties? We guarantee **push, ability, capital, personal solicitation, square dealing and success.**

Electricity yours,
**People's Electric Co.**

P. S.—No time for cheap stuff.

• • • •

SECOND.

**To Our Very Dear Friends, Our Past, Present and Future Customers:**

*Gentlemen:*—We know you are a busy people, over-worked, and therefore, to make a long story short, beg to say that we handle only what our personal experience with you has taught us to be of greatest practical value. You, the scholars of the past, are the teachers of to-day.

Our stock is made up of those articles best adapted to your wants. We guarantee **correct interpretation of your orders, prompt attention, personal attention, quick dispatch, clean goods properly packed, invoices correctly made.**

Your Electrical Servants,
**People's Electric Co.**

THIRD.

**To Our Business Friends:**

THE PEOPLE'S ELECTRIC CO. was organized and incorporated under the State Laws of Wisconsin for the purpose of dealing in all kinds of electrical supplies. We are qualified by experience in the shipping room, the counting room, on the road, in the central station, in the university and in practical installation.

Our aim is to improve the electrical business in all its various branches and do our part in placing it in the foremost rank of commercial enterprises. Our success has been beyond our expectations, due to the confidence of our **business friends.**

Very respectfully yours, **People's Electric Co.**

OUR TERRITORY.

WE HAVE TRAVELED IT FOR YEARS.

# PEOPLE'S : ELECTRIC : COMPANY,

**We are selling goods manufactured by**
Wagner Electric Mfg. Co., St. Louis.
Columbia Incandescent Lamp Co., St. Louis.
H. T. Paiste Co., Philadelphia.
W. C. Vosburg Mfg. Co., Brooklyn.
Northern Electrical Mfg. Co.

The Electrical Supply House of the Northwest,
MADISON, WIS., U. S. A.

**We are selling goods manufactured by**
Western Electric Co.
New York Insulated Wire Co.
Bryant Electric Co.
Anchor Electric Co.
Standard Telephone & Electrical Co.
And others of equal prominence.

**DO YOU WANT THE SERVICES OF RELIABLE WESTESN HUSTLERS?**

# THE LUNGEN BUZZERS.

## ....PIVOTED ARMATURE....

**POSITIVE,**
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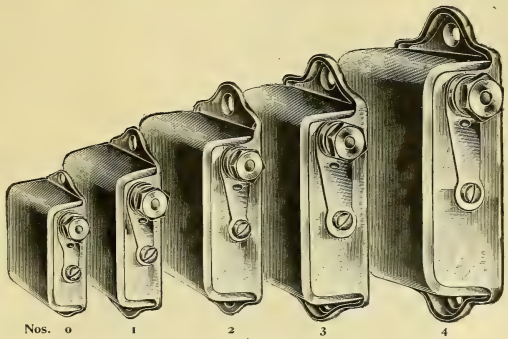
**COMPACT.**

Entirely Nickel Plated.
For Telephone Work, etc.
Arranged to operate in
**SERIES.**



Nos. 0 1 2 3 4

(Cuts Full Size.)
Catalogue No. 15.

Have you received our 1896 Catalogue? It describes (with prices) all our Specialties.

SEND FOR IT.

You can get them of your SUPPLY HOUSE, or of

# EDWARDS & CO.,

144th St. and 4th Ave., NEW YORK.

# TO SUPPLY DEALERS.

Be sure to visit our exhibit at the New York Exposition and see the full line of specialties which we manufacture.

To those who are unable to attend the exposition we shall be pleased to mail descriptive catalogues and quote prices.

## OUR SPECIALTIES ARE GUARANTEED.

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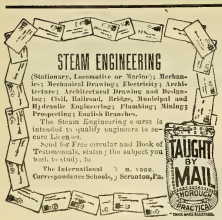
. . . BOSTON . . .

Chicago Office: 1654-5-6 Monadnock Blk.


STEAM ENGINEERING
(Stationary, Locomotive or Marine); Mechanics; Mechanical Drawing; Electricity; Architecture; Architectural Drawing and Designing; Civil, Railroad, Bridge, Municipal and Hydraulic Engineering; Plumbing; Mining; Prospecting; English Branches.
The Steam Engineering course is intended to qualify engineers to secure Licenses.
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DEALER IN

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FUSE WIRE AND LINKS FOR ALL SYSTEMS, Correct Carrying Capacity. Absolutely Uniform.

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THE EMERSON ELECTRIC MFG. CO.,

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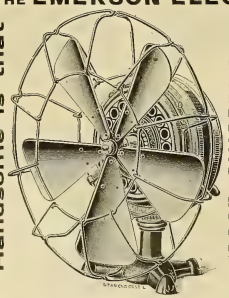
And 112 Liberty St., New York.

"Handsome is that Handsome does."



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Current Consumption:

"Meston" 12-inch fan, 60 to 70 watts.
" 16-inch fan, 70 watts.
Induction 12-inch fan, 7,200 alts., 80 to 90 watts
Induction 16-inch fan, 7,200 alts., 110 to 125 watts.
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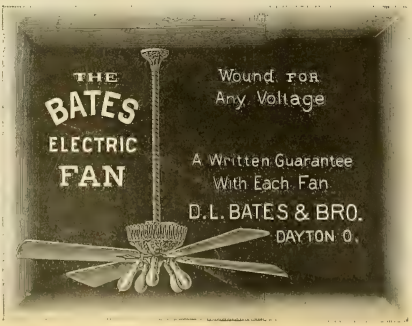
CHEAPEST

Fan Motors on the market because

BEST.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A Written Guarantee With Each Fan
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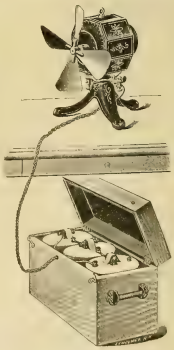

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Factory, Orange N. J.

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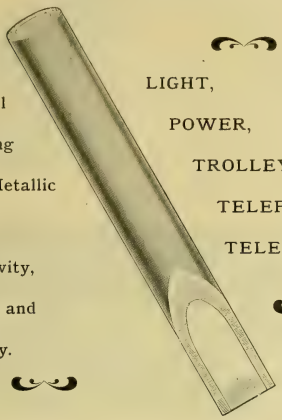
Copper and Steel Combining the Bi-Metallic Effect, Conductivity, Strength and Durability.



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TROLLEY,
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**See Roebling's Exhibit at Exposition.**

Prices and general information upon application to

## Bi-Metallic Electric Transmission Co.,

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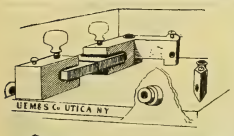


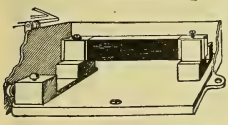

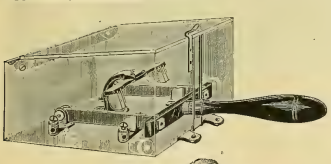

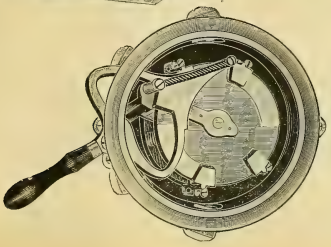

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Of the "good things" we have for users. Correspond with us, it will pay you.

## UTICA ELECTRICAL MFG. & SUPPLY CO.,

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# Why Are They Alike?

Because they are all....

## HUNG-UP.

That's one of the Many Points in our

## Hang-Up Dry... Battery

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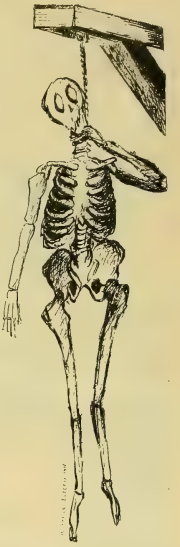

But there are others, among them

**High E. M. F.,**
**Long Life,**
**Economy in Installing,**
And Last, but not Least,
**The PRICE.**

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## The F. J. Pearson Mfg. Co.,

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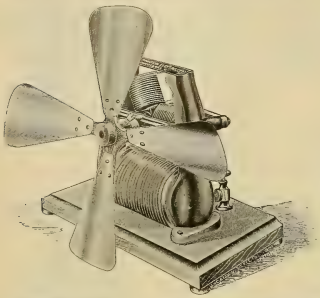

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No. 5 Motor, complete with 10-inch fan, wound for 4, 6, 8 or 10 volts, price $ 7.50.
No. 5 Motor, wound for 110 volts, with either 10 or 12-inch fan - - 10.00
No. 5 Outfit, consisting of one No. 5 Motor with fan, two No. 6 Motor batteries with one charge of solution which will run motor 160 hours, price, complete outfit - - - - - - - - - - - - 18.00
Wire fan guard, extra - - - - - - - - - - - - 1.00

**The Motor** is guaranteed first-class, nicely finished and efficient. We furnish either four or six blade fans, as desired.
**The No. 6 Battery** is something new and will produce a current of electricity equal to a dynamo current for motive power at a less cost than charged by established light and power companies or any other primary battery on the market. It is easily maintained, solution costs about 30 cents per cell to recharge. It is furni-hed in a concentrated form, requiring nothing but the addition of six times its bulk of water. See circular for full information.
Battery complete, hard rubber cell 7x7x9 inches, 1,000 ampere hour capacity, price $6.50.

Send address for descriptive circulars or two 2-cent stamps for catalogue.

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# *JUST NOW*

Is the time to decide on the Fan Motor you intend to handle this season. Our direct current motor is equal to the best, if its intrinsic merit is considered.

**Annunciators, Medical Farradic Batteries.**
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**Of all Descriptions.**
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NEW YORK: 136 Liberty St., Chapin & Douglas.
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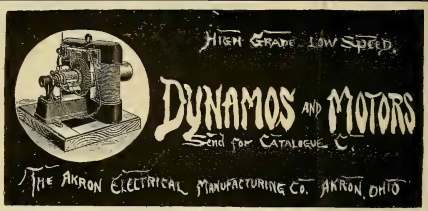


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**Turned Iron Shafting.**
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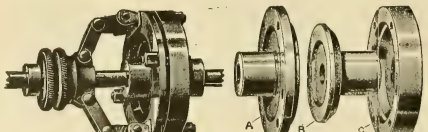


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We have everything used for Transmission of Power in Electric Light and Power Stations or Isolated Plants. WRITE US FOR ESTIMATES.
New circulars in regard to our stock. Write us and save money.

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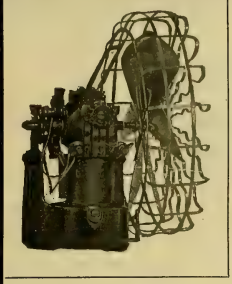

## *LOTS OF OTHER FAN OUTFITS*

# BUT ! ! !

**The C-W FAN OUTFITS have 6 BLADE, 12 and 16-INCH FANS instead of the usual 10 and 15-inch 4 Blade.**

They will therefore do **BIG WORK** if you want it.

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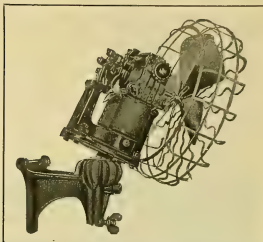

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Direct Current, Multipolar Slow Speed, External Armature Generators and Motors, especially adapted for direct connection.
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**SIEMENS' Band Arc Lamps for Direct and Alternating Current, Electric Mining Locomotives, Steam Locomotives, etc., etc.**

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Oils, Ammonia or Alkalies do not affect it.

Steam Joints Made Instantly.

NO BAKING OR FOLLOWING UP.

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OUR CLAIMS for efficiency and regulation have been SUBSTANTIATED by tests made all over the country, and we have received many letters from college professors congratulating us on the REMARKABLE RESULTS of tests made by them on our transformers.

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Transformers of Any Size.

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Transformers of the Highest Possible Efficiency.

Remember, Efficiency affects your Coal Pile. The cheapest Transformer is sure to prove the most expensive in the end. . . . . ,

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Perfect in regulation and cheap to buy.

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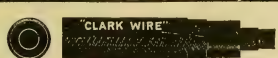
For Arc Light and Trolley Cord.

SAMSON CORDAGE WORKS, - BOSTON, MASS.

THE

# "CLARK" WIRE.

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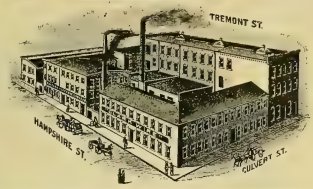
For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

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The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

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A Dry Soluble Compound for all ZINC CARBON BATTERIES.

Prominent Telephone Companies after testing the Compound have adopted it. Costs about one-half as much as the solution.
Saves labor and expense of carting dangerous liquids to the different terminals.

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"MICANITE" Commutator Rings five feet in diameter, and special forms of insulation for various designs of electrical apparatus. Our exhibit is on the second floor and is one of great interest to builders of electrical machinery.

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# Gordon Primary Battery

EXCELS IN

Long Life, Efficiency,
Economy, Adaptability,
It is absolutely Non-Freezing.
Labor Saving,
Free from Local Action,
Freedom from Gases and Odors.
Superior Generation of Energy.

These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America.
Send for descriptive circular and price list. We guarantee all our Cells.

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Position by young man having had large practical experience with electric lighting and power machinery, and understands arc light repairing; also experienced in the care of steam plants. Can give good references.

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By electrician of technical education and long practical experience in all kinds of testing, calculations, designing and manufacture of instruments, lamps and machinery. Can, if desired, furnish complete equipment of first-class instruments for a laboratory or testing department for all kinds of electrical and photometric tests. Might accept engagement for only part of my time. Address "Franklan," care of Western Electrician, Suite 510 Marquette Bldg., Chicago.

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4000 rubber storage battery jars; 28 storage battery cut-outs; 50 ammeters; 5 focusing arc lamps; 1400 incandescent lamps, 48 to 60 volts; two 100 light incandescent dynamos; five 20 arc light dynamos; five 15 arc light dynamos; one 225 volt 50 ampere dynamo; one 250 volt 100 ampere dynamo. New wire of various sizes. Any of above will be sold low or will exchange for old material. WALSH'S SONS & CO., Newark, N. J.

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Sealed proposals will be received by the State Board of Control of the State of Wisconsin up to 12 o'clock noon of Tuesday, May 26, 1896, for the material and labor necessary for the construction of an electric lighting, steam engine and boiler plant with all necessary appurtenances as per complete plans and specifications on file in the office of the State Board of Control, Madison, Wis., also on file in the office of Charles G. Armstrong, Consulting Electrical Engineer, 1306-1307 Great Northern Bldg., Chicago, Ill.

Bids must be accompanied by a certified check in the sum of 2 per cent. of the amount of the bid, payable to the order of Hans B. Warner, President; to be forfeited to the State of Wisconsin in case the bidder or bidders chosen fail to enter into a contract with the Board, and furnish a satisfactory bond for the proper construction of the same, within ten days after the acceptance of their proposal.

Bids must be sealed and addressed to the undersigned, must be plainly marked on the envelope "Proposals for Engine and Boiler Plant" or "Proposals for Electric Lighting Plant" (as the case may be) for the State Prison, Waupun, Wis.

The State Board of Control reserve the right to accept any bid or combination of bids or to reject any or all bids which the Board may deem to the advantage of the State.

By order of the State Board of Control.

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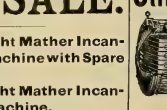

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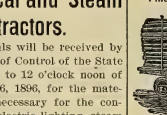

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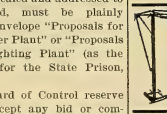

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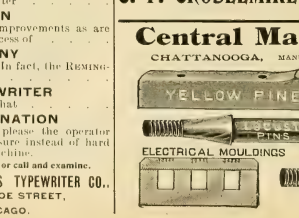
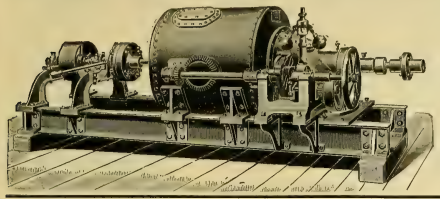


# Victor Turbine Water Wheel.



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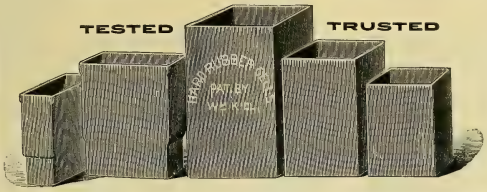

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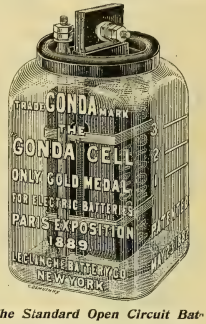


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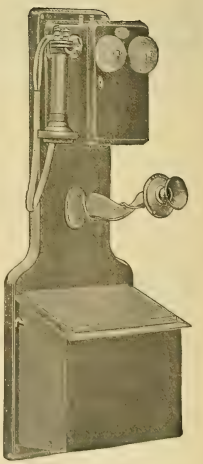

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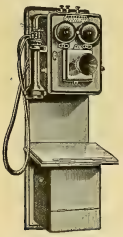

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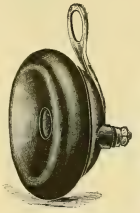

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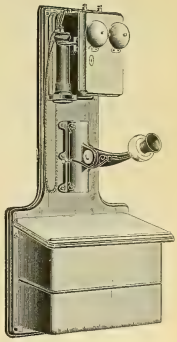

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| Cambridge Telephone Co., Cambridgeboro, Pa. | 50 |
| Ellsworth Telephone Co., Ellsworth, Kan. | 50 |
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| Lynchburg Telephone Co., Lynchburg, Va. | 400 |
| Home Telephone Co., Bloomington, Ill. | 400 |
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| Hanover Telephone Co., Hanover, Pa. | 150 |
| Citizens' Telephone Co., Honesdale, Pa. | 100 |
| Latrobe Telephone Co., Latrobe, Pa. | 100 |
| Indiana Telephone Co., Indiana, Pa. | 100 |
| Ticonderoga Telephone Co., Ticonderoga, N. Y. | 100 |
| Boone Co. Telephone Co., Boone, Ia. | 200 |
| Northwestern Telephone Co., Charles City, Ia. | 100 |
| Chariton Telephone Co., Chariton, Ia. | 100 |
| Louisiana Telephone Co., Louisiana, Mo. | 25 |
| McKeesport Telephone Co., McKeesport, Pa. | 300 |
| Mt. Vernon Telephone Co., Mt. Vernon, Ill. | 100 |
| Effingham Telephone Co., Effingham, Ill. | 100 |
| Wapakoneta Telephone Co., Wapakoneta, O. | 100 |
| Marysville Telephone Co., Marysville O. | 100 |
| People's Telephone & Telegraph Co., Hot Springs, S. D. | 75 |
| Charleston Telephone Co., Charleston, Ill. | 100 |
| Northwestern Ohio Telephone Co., Wauseon, O. | 100 |
| McGhie & Moore Telephone Co., Sistersville, W. Va. | 200 |
| Montpelier Telephone Co., Montpelier, Ind. | 50 |
| Co-operative Telephone Co., Lake Odessa, Mich. | 50 |
| Bishop Telephone Co., Central City, Ia. | 25 |
| Du Quoin Telephone Co., Du Quoin, Ill. | 100 |
| Keithsburg Telephone Co., Keithsburg, Ill. | 100 |
| Enosburgh Telephone Co., Enosburgh Falls, Vt. | 100 |
| Home Telephone Co., Lewisburg, Pa. | |
| Shamokin Valley Telephone Co. | |
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| Williamsport Telephone Co. | |
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| Cambria Iron Works, Johnstown, Pa. | 100 |
| Armour & Company, Chicago, Ill. | 50 |
| Chicago Lumbering Company, Manistique, Mich. | 50 |
| Cannisius College, Buffalo, N. Y. | |
| The Johnson Company, Lorain, O., and Johnstown, Pa. | 50 |
| Columbus Dry Goods Company, Chicago, Ill. | |
| Geo. W. Davidson, Warrensburg, N. Y. | |
| Frank A. Yeakle, Riverside, California | |
| Whitman & Barnes Mfg. Co., Akron, O., and West Pullman, Ill. | |
| Monarch Brewing Company, Chicago, Ill. | |
| Riverside Water Company, Riverside, Cal. | |
| U. S. Government, Washington, D. C. | |
| W. H. H. Cash, New Lisbon, Wis. | |
| Winona Hotel, Winona, Minn. | |
| Amity Land & Irrigation Co., Lamar, Colo. | |
| Geo. Watt, Milan, Mo. | |
| Cook County Hospital, Chicago, Ill. | 25 |
| Field Columbian Museum, Chicago, Ill. | 20 |
| Illinois State Reformatory, Pontiac, Ill. | 15 |
| Hallo & Davis, Chicago, Ill. | |
| Lord & Thomas, Chicago, Ill. | |
| Geo. H. Evans, Oroville, Cal. | 20 |
| J. B. Rhodes, Zanesville, O. | |
| P. D. Armour, Jr., Oconomowoc, Wis. | |



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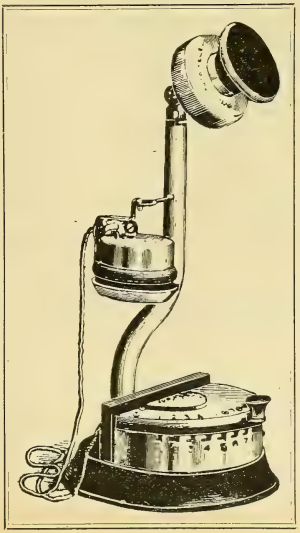

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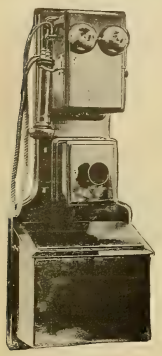

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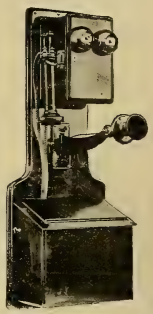

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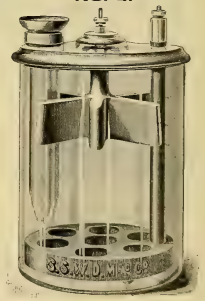


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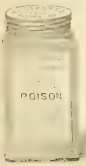


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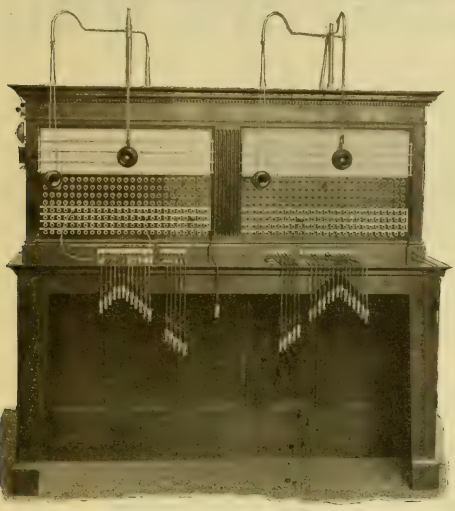

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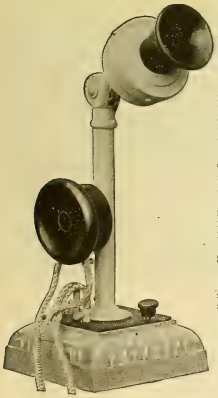

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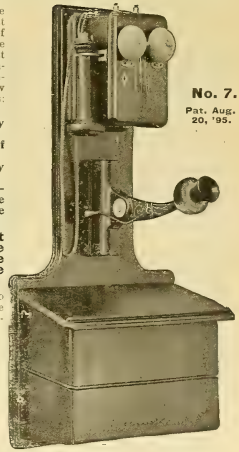

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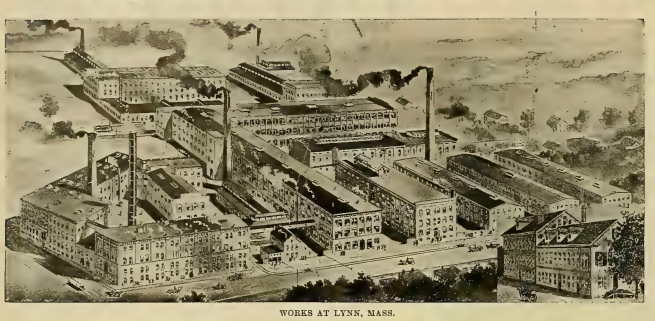

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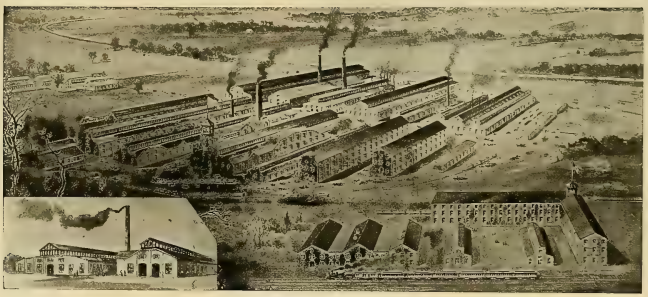

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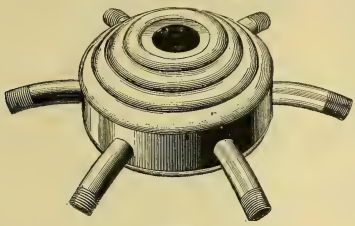

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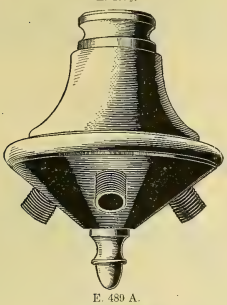

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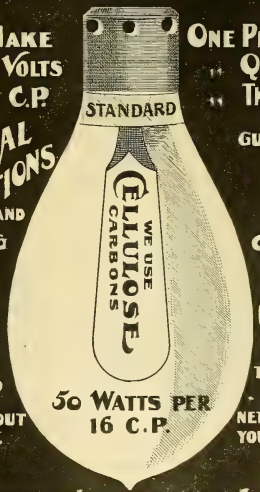


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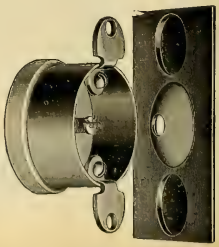

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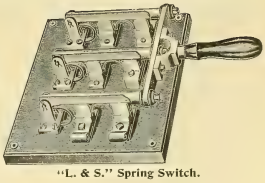

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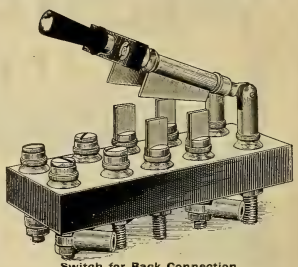

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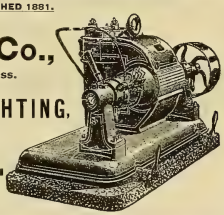

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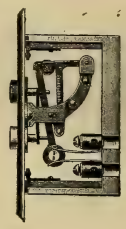

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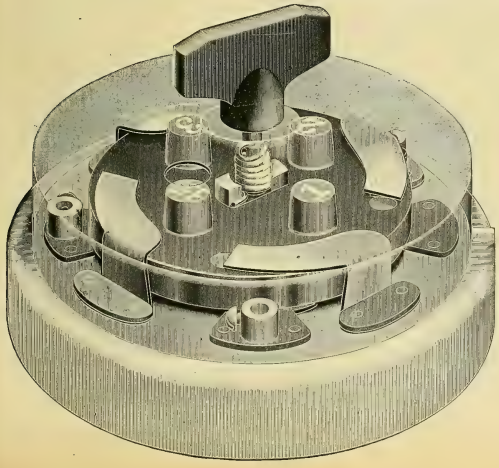

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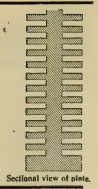
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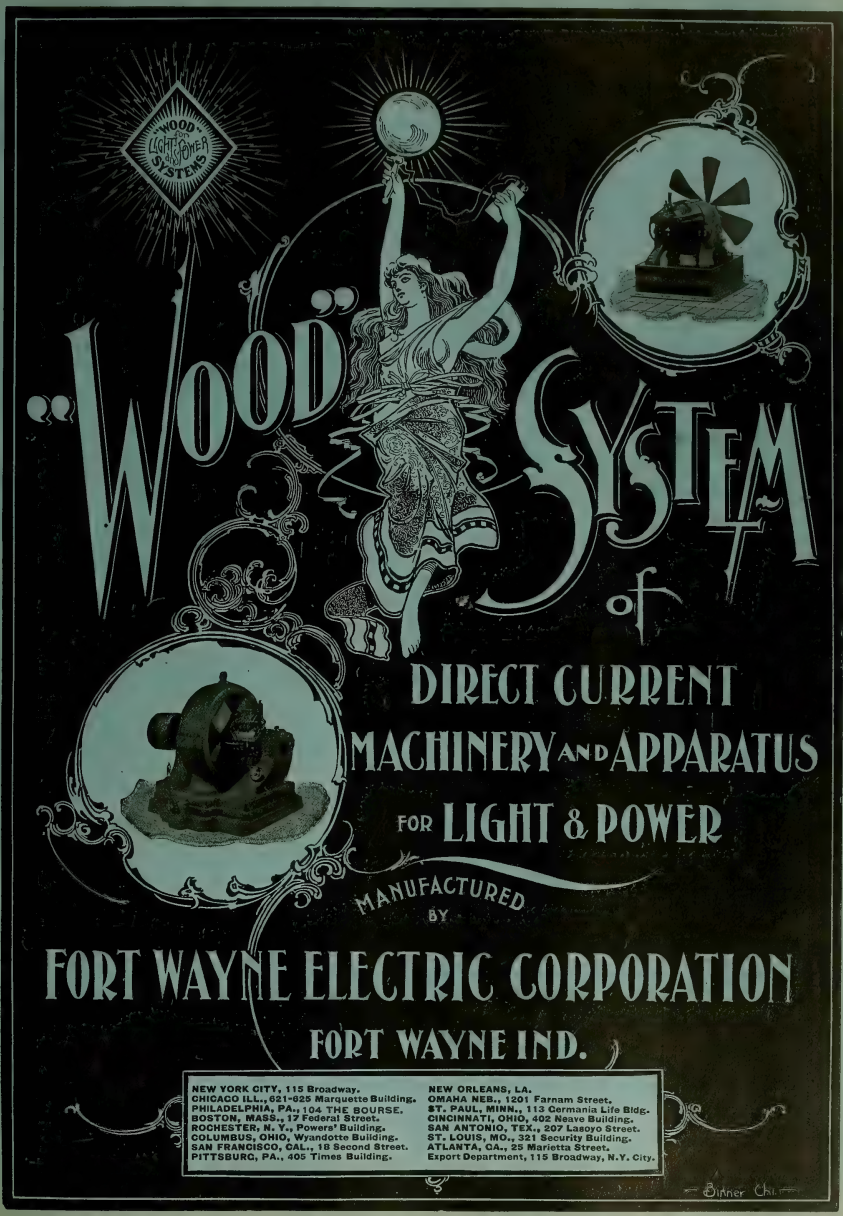
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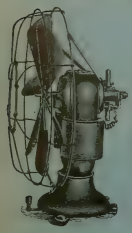

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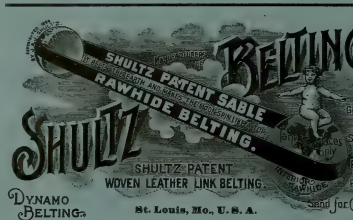


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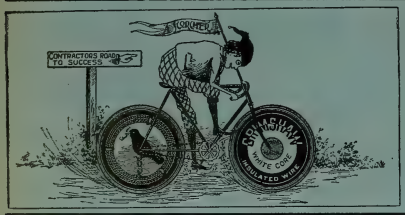


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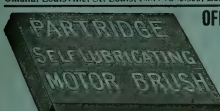


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Soft Cored Carbons (NOT HOLLOW),

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These instruments are based upon the same general principle and are just as accurate as our regular Standard Portable Direct Current Voltmeters and Ammeters, but are much larger, and the working parts are inclosed in a neatly designed, dust-proof cast-iron case which effectively shields the instruments from disturbing influences of external magnetic fields.

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PIVOTAL BOSTON TROLLEYS

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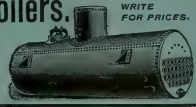

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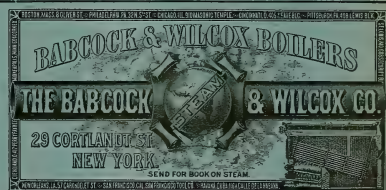

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# INSULATING COMPOUNDS

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Strong, Durable and Effective.

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are Manufacturing Electricians,

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**Dental, Medical and Surgical Apparatus.**

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AND
**General Electrical Supplies.**

Magnets wound to specifications, regular convolutions and perfect layers guaranteed.

"Upon my life it will do wondrous well."—*Shakespeare.*

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**Cored and Solid for Direct Lighting.**

## ...LARGE IMPORTATION JUST ARRIVED...

General Western Agents:

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**..DEALERS IN ELECTRIC LIGHTING SUPPLIES..**

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## NEW ERA IN ELECTRIC ADVERTISING.

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**Ask your NEAREST SUPPLY HOUSE for Sample or write**

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**High Grade Incandescent Lamps,**

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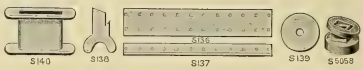


## All Controllers are Insulated with Vulcabeston.

**G. E. 800 and Westinghouse Commutator Rings, Brush Holder Bushings and Field Spools.**

**SEND FOR PRICE LIST.**

Moulded Mica Trolley Insulating Materials, Frogs, Crossings, Tree Insulators, Weatherproof Sockets, etc.

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Generators for Power Transmission or Isolated Lighting.
CARD Generators are all Multipolar and Slow Speed.

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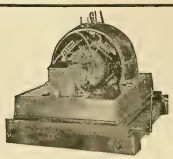

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Multipolar Slow Speed Stationary Motors.
Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

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## MI-CA.

In the sheet, and cut to any size or pattern. SEGMENTS, Washers, and Solid Sheet Mica Segments, gauged to thickness for all the standard railway motors. . . .

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MICA MICA MICA

THE SEASON 1896.

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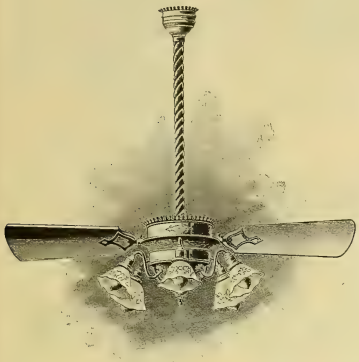

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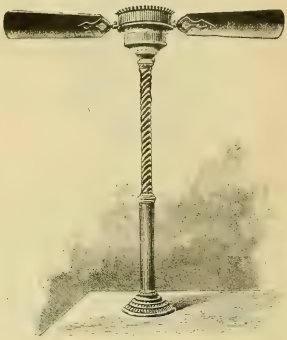

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TWO OR FOUR-BLADE FANS.

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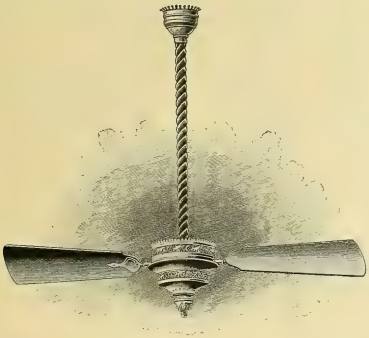
Exhaust Wheels.



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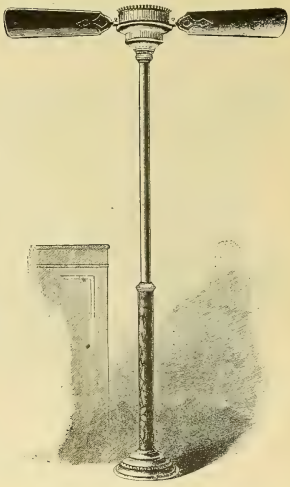
COVERING SUSPENDED ELECTRIC

Fans



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ELIZABETHPORT, N. J.

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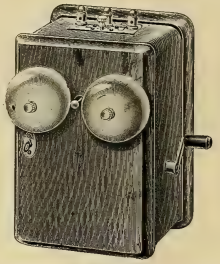
**NO. 7707**
Iron Box Bell.

Ask your dealer for the No. 7707 Iron Box Bell.



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We sell Magneto parts separately.

. . . Quotations on application.

**STANDARD**
Wood Box Bell.

Kindly refer to this paper when writ ng.

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MANUFACTURERS ELECTRICAL SUPPLIES,

BEDFORD, DIVISION AND CANTON STREETS, BROOKLYN, N. Y.

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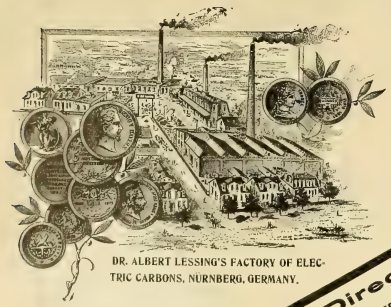

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Carbons for Direct or Alternating Currents.

WRITE FOR PRICES AND SAMPLES TO

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SOME OF THE MEDALS RECEIVED FOR SUPERIOR QUALITY OF THE DR. LESSING CARBONS.

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**New Catalogue will be Sent on Application.**

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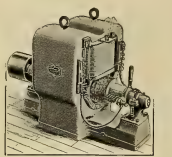
MAKERS OF

## Dynamos and Power Generators,

Direct Connected or Belted. for Isolated or Central Station Plants.

## Motors for Power Transmission,

Slow, Medium and High Speeds.



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Electric Appliance Co.
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Menominee El. &. Mech. Co.
Partrick & Carter Co.

**Arc Lamps.**
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Elec Art Lt. Co.
Fleming-Spence Elec. Co.
Ft. Wayne Elec. Corporation.
Manhattan Gen'l. Con. Co.
Perkins Elec. Switch Mfg. Co.
Van Nuis, C. S.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Assayers.**
Nat'l. Ore & Reduction Co.

**Batteries and Jars.**
Boynton Multivolt Batt'y Co.
Butler Hard Rubber Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Edison Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Electric Storage Battery Co.
Franklin Elec. & Mrg. Co.
Gordon-Burnham Bat. Co.
Leclanche Battery Co., The.
Mason, J. W.
Menominee El. & Mech. Co.
Northwest Engineering Co.
Ohio Storage Battery Co.
Partrick & Carter Co.
Pearson, F. J. Mfg. Co.
Western Electric Co.
White, S. S. Dental Mfg. Co

**Bells.**
Baxter H. E. & C.
Edwards & Co.
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
National Electric Co.
Partrick & Carter Co.
Western Electric Co.

**Belting.**
Channon Co., H.
Chicago Belting Co.
Jewell Belting Co.
Rhoads & Sons, J. E.
Shultz Belting Co.

**Bicycles.**
Adams & Westlake Co.
Monarch Cycle Mfg. Co.
Pope Mfg. Co.

**Boilers.**
Abendroth & Root Mfg. Co.
American Boiler Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Collins & Co., H. E.
Freeman & Sons Mfg. Co.
Moyes, L. M.
Murray Iron Works Co.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H.
Phosphor BronzeSm.Co.,Ltd.

**Brushes.**
Bernardin, F. M.
Boudreaux Dyn. Brush Co.
Holmes Fibre-Graphite Co.
Mason, J. W.
Phila. Elec. & Mfg. Co.
Partridge Carbon Co.
Solar Carbon & Mfg. Co.
Wirt, Chas.

**Burglar Alarms.**
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
Partrick & Carter Co.
Western Electric Co.

**Cables** (See Insulated Wires.)

**Cables, Electric** (See Insulated Wires.), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R
Eastern Electric Cable Co.
Elec. Engr. & Supply Co.
Moore, Alfred F
New York Ins. Wire Co.
Nat'l Underground Cable Co
Simplex Electrical Co.
Standard Underground C. Co
Western Electric Co

**Carbons, Points & Plates.**
American Carbon Co
Bernardin F. M.
Chicago Edison Co
Chicago General Fixture Co
General Electric Co
Mason, J. W.
Partridge Carbon Co.
Reisinger, Hugo.
Schiff, Jordan & Co.
Solar Carbon & Mfg. Co.
Standard Paint Co.
Strauss & Co., W. L.
Washington Carbon Co.
Wertheim, Ed.
Western Electric Co.

**Cigar Lighters.**
National Electric Co.

**Compound.**
Standard Paint Co.
Voltak Supply Co.

**Conduits.**
Interior Conduit & Ins. Co.

**Construction & Repairs.**
Bernardin, F. M.
Ft. Wayne Elec. Corporation.
Richards & Meacham.

**Contractors and Electric Light Plants.**
Akron Elec. Mfg. Co.
Arnold, B. J.
Arnold Power Station Co
Bain, Foree.
Brush Electric Co.
Bryan & Humphrey.
Card Electric Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Interior Conduit & Ins. Co.
Northern Electl. Mfg. Co.
Schott, W. H.
Siemens & Halske Elec. Co.
United Elec ImprovementCo.
Walker Co.
Warren Elec. Co.
Westinghouse Elec & Mfg Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas H.
Bowers Bros.

**Copper Wires.**
American Electrical Works.
Bernardin, F. M.
Besly & Co., Chas H.
Brixey, W. R.
Chicago Edison Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Menominee El. & Mech. Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Crookes' Tubes.**
LeRoy, J. A.
Perkins Elec. Switch Mfg.Co.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Bernardin, F. M.
Brady, T. H.
Central Mfg. Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Mason, J. W.
Nuttall Co., R. D.
Partrick & Carter Co.

**Cut-Outs and Switches.**
Anchor Electric Co.
Anderson, Albert & J. M.
Ball, H. P. Mfg. Co.
Bernardin, F. M.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Elec. Co.
Hart & Hegeman Mfg. Co.
Interior Conduit & Ins. Co.
Mason, J. W.
Menominee El. & Mech. Co.
Morrison Southern El. Co.
Nuttall Co., R. D.
Partrick & Carter Co.
Perkins Elec. Switch Mfg Co.
Phil. Elec. & Mfg. Co.
Shawmut Fuse Wire Co.
Utica El. Mfg. & Sup Co.
Westinghouse El. & Mfg. Co.

**Dynamos.**
Akron Elec. Mfg. Co.
American Engine Co.
Brush Electric Co.
Card Electric Co.
Colburn Elec. Mfg. Co.
Crocker-Wheeler Elec. Co.
Dallett & Co., Thos. H.
Eddy Elec. Mfg. Co.
Electrical Eng. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hine & Co., L. A.
Interior Conduit & Ins. Co.
Lafayette Eng. & El. Wks.
Mayo, V. J.
McEwen, J. H. Mfg. Co.
Northern Electl. Mfg. Co.
Roth Bros. & Co.
Siemens & Halske Elec. Co.
Toomey, Frank.
Triumph Elec. Co.
Walker Co.
Wallace Electric Co.
Warren Electric Co.
Westinghouse El. & Mfg. Co.

**Economizers, Fuel.**
Fuel Economizer Co.

**Electric Heaters.**
American El. Heat. Corp.

**Electric Railways.**
Brush Electric Co.
Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryan & Humphrey.
Eddy Elec. Mfg. Co.
Schott, W. H.

**Electrical Instruments.**
Anderson, Albert & J. M
Bernardin, F. M.
Chicago Edison Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Interior Conduit & Ins. Co.
Norton, C. E.
Nuttall Co., R. D.
Partrick & Carter Co.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Electrical Specialties.**
American Elec. Fuse Co.
Commercial Elec. Sup. Co.
Menominee El. & Mech. Co.
Pearson, F. J. Mfg. Co.
Phila. Elec. & Mfg. Co.
Rau Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Elevators.**
Sprague El. Elevator Co.

**Engines, Gas.**
Norman Co., J. J.
Otto Gas Engine Wks.
Weber Gas & Gaso'l Eng. Co.

**Engines, Steam**
American Engine Co.
Ball & Wood Co., The.
Ball Engine Co.
McEwen, J. H. Mfg. Co.
Murray Iron Works Co.
Racine Hardware Co.
Toomey, Frank.
Westinghouse Mach. Co.
Weston Engine Co.

**Engravers.**
Chic. Electro & Stereo Co.
Illinois Engraving Co.

**Exhaust Pipe Heads.**
Faucett, I. L.

**Fan Outfits.**
Bates & Bro., D. L.
Crocker-Wheeler Elec. Co.
Diehl & Co.
Edison Mfg. Co.
Emerson Elec. Mfg. Co.
Franklin Elec. & Mfg. Co.
Hamerschlag & Co.
Interior Conduit & Ins. Co.
Roth Bros. & Co.
Tuerk Water Meter Co.
Westinghouse El. & Mfg. Co.

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Goubert Mfg. Co.

**Fibre.**
Holmes Fibre-Graphite Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

**Files.**
Barnett Co., G. & H.

**Fire Alarms.**
Partrick & Carter Co.
Western Electric Co.

**Forges.**
Union Heater Supply Co.

**Fuse Wire.**
American Elec. Fuse Co.
Brixey, W. R
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Shawmut Fuse Wire Co.

**Gaskets.**
Peerless Rubber Mfg. Co.
U. S. Min. Wool Co.

**Gas Lighting, Electric.**
Partrick & Carter Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anchor Electric Co.
Anderson, Albert & J. M.
Andrae & Sons Co., J.
Bernardin, F. M.
Besly & Co., Chas. H.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Clymer & Heilman.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Cutter, Geo.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Elec Engr. & Supply Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Hill, W. S., Elec. Co.
Huebel & Manger.
Interior Conduit & Ins. Co.
Manhattan Elec. Sup. Co.
Mason, J. W.
Menominee El. & Mech. Co.
Metropolitan Electric Co.
Morrison Southern El. Co.
National Electric Co.
Northwest Engineering Co.
Norton, C. E
Ohio Electric Works.
Partrick & Carter Co.
Pearson, F. J. Mfg. Co.
Peru Elec. Mfg. Co.
Peoples' Elec. Co.
Phila. Elec. & Mfg. Co.
Shawmut Fuse Wire Co.
Sioux City Brass Works.
Standard Tel. & Elec. Co.
Utica El Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

**Globes and Electrical Glassware.**
Chicago Gen'l Fixture Co.
Gleason, E. P. Mfg. Co.
Phoenix Glass Co.

**Gov'nors, Water Wheel.**
LombardWaterWheelGv.Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.

**Insulators and Insulating Materials.**
Anchor Electric Co.
Anderson, Albert & J. M.
Bernardin, F. M.
Brixey, W. R.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Empire China Works.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co , The.
Hart & Hegeman Mfg. Co.
Hine & Co., L. A.
Interior Conduit & Ins. Co.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
Mason, J. W.
Menominee El. & Mech. Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.
Utica El. Mfg. & Sup. Co.

**Insulated Wires and Cables—Magnet Wires.**
American Electrical Works.
Brixey, W. R.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Elec. Engr. & Supply Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
Nat'l Underground Cable Co.
New York Insulated Wire Co.
Okonite Co., The.
Partrick & Carter Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.,
Orient Electric Co.
Partrick & Carter Co.
Perkins Elec. Switch Mfg. Co.
Sawyer-Man Elec. Co.
Standard Incan. Lamp Co.
United Elec. Imp. Co.
Westinghouse El. & Mfg. Co.

**Lightning Arresters.**
Electric Appliance Co.
Garton-Daniels Electric Co.
General Electric Co.
Utica El. Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Am. Tool & Mach. Co.
Besly & Co., Chas. H.
Bliss Co., E. W.
Ferracute Machine Co.
Lewis Tool Co.
Murray Iron Works Co.

**Mica.**
Bowers Bros.
Electrical Eng. Co.
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.
Schoonmaker, A. O.
Sills & Co., W. H.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Akron Elec. Mfg. Co.
Bates & Bro., D. L.
Brush Electric Co.
Card Electric Co.
Colburn El. Mfg. Co.
Crocker-Wheeler Elec. Co.
Dallett & Co., Thos. H.
Eddy Elec. Mfg. Co.
Elec. Engr. & Supply Co.
Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
Franklin Elec. & Mfg. Co.
General Electric Co.
Hamerschlag & Co.
Interior Conduit & Ins. Co.
Mayo, V. J.
Menominee El. & Mech. Co.
Northern Electl. Mfg. Co.
Roth Bros. & Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Walker Co.
Westinghouse El. & Mfg. Co.

**Oil Feeders.**
Dailey, Jas. W.

**Packing.**
Besly & Co. Chas. H.
Garlock Packing Co.
Peerless Rubber Mfg. Co.

**Paints.**
Standard Paint Co.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co.Ltd.

**Platinum.**
Baker & Co.
Croselmire & Son, C. F.

**Poles.**
Bernardin, F. M.
Brown, DeWitt, Cedar Co.
Central Mfg. Co.
Hart, C. S.
Lewis & Co., A. L.
Lindsley Bros.
Morris, Tasker & Co.
Nuttall Co., R. D.
Perrizo, Paul, Jr. Co.
Sterling, W. C. & Son.
Valentine-Clark Co.

**Porcelain.**
Commercial Elec. Sup. Co.
Empire China Works.
General Electric Co.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Electric Appliance Co.
National Electric Co.
Northwest Engineering Co.
Partrick & Carter Co.

**Rheostats.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Speaking Tubes.**
Electric Appliance Co.
Partrick & Carter Co.

**Speed Indicators.**
Besly & Co., Chas. H.
Norton, C. E.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Ohio Storage Battery Co.

**Street Cars.**
Brill, J. G. Co
Ladd, A. W.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Chicago Ins. Wire Co
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Elec. Selec. & Signal Co.
Electric Appliance Co.
Partrick & Carter Co.
Western Electric Co.

**Telephones and Telephone Material.**
Andrae & Sons Co., J.
Chicago Telephone Sup. Co.
Commercial Elec. Sup. Co.
Conn. Tel. & El. Co.
Electrical Eng. Co.
Elgin Telephone Co.
Farr Tel. & Const. Supply Co.
Keystone Telephone Co.
Manhattan Elec. Sup. Co.
Mason. J. W.
Mianus Elec. Co.
Northwest Engineering Co.
Phoenix Int. Tel. Co.
Richards & Meacham.
Standard Tel. & Elec. Co.
Viaduct Mfg. Co.
Western Elec. Co.
Western Tel. Cons. Co.
Williams & Abbott El. Co.

**Transformers.**
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Stanley Electric Mfg. Co.
Wagner El. Mfg. Co.
Westinghouse El. & Mfg. Co.

**Trolley Cord.**
Bernardin, F. M.
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stilwell-Bierce & Smith Vaile Co

**Universities.**
Cor. School of Technology.
Int. Corr. Schools.

**Valves.**
Culver Mfg. Co.

**Water Wheels.**
Leffel & Co , Jas.
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas H.
Bi-Metallic El. Trans. Co.
Brixey, W. R.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co , R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Standard Underground C Co.

**X Ray Outfits.**
LeRoy, J. A.


For Alphabetical Index of Advertisements See Page III.

Do you use **CORED CARBONS!** If so, you

do not need to depend on Foreign Manufacturers for your supply. . . . . .

The Celebrated **HELIOS** .....Carbons are

now manufactured in America, and all sizes carried in stock by

# The Washington Carbon Co., PITTSBURGH, PA.

**WRITE FOR PRICES AND SAMPLES.**

Motor and Generator Brushes. Battery Plates and Specialties.

## Highest Grade Solid Carbons

**FOR SERIES ARC LIGHTING.**

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**THE**

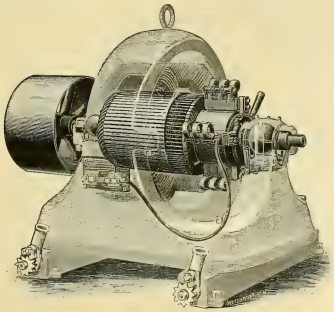
# Triumph Electric Co.,

....CINCINNATI, OHIO....

MANUFACTURERS OF

## Medium and Slow Speed Electrical Apparatus.

Ventilated Armature,
Low Heat,
Simple Construction,
Automatic Lubrication.

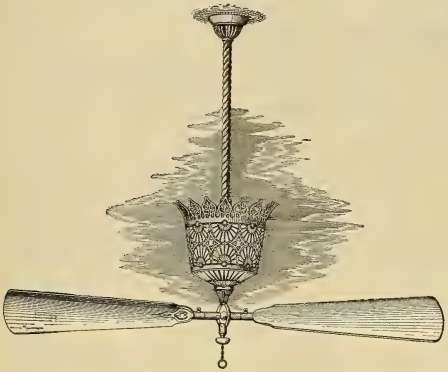


Multipolar and Bi-Polar
DYNAMOS
and
MOTORS.

AGENTS IN ALL LARGE CITIES. Write for Catalogue "M." OFFICE AND FACTORY:—610-616 Baymiller Street.

# Western Electric Company.

## ARIEL ALTERNATING CURRENT FAN MOTOR.



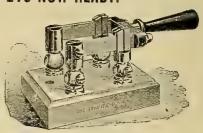
**It is** strong, durable, highly efficient, handsome, noiseless.
**It has** no commutator. No winding on the armature. No chance to burn out. A blade shifter changing the angle of the blades without stopping.
**It runs 125** revolutions per minute.
**The motors** are of the well-known induction type.
**The bearings** are self-oiling, chambers once filled containing enough oil to last an entire season.
**Made for** alternating currents of **50** or **100** volts, **7,200, 14,000** to **16,000** alternations per minute.

—ALSO—

**Crescent Desk and Ceiling Fans, Meston Alternating Current Desk Fans, Lundell Desk Fans, Globe Desk Fans.**

FAN MOTOR SHEET NO. 210 NOW READY.

Bryant Sockets, P. & S. Tubes,
Interior Conduit, Insulated Wire,
Lamp Cord,
Hill Station Switches,
Weston Instruments,
Switches, all Kinds,
At Lowest Prices.



NEW YORK, **WESTERN ELECTRIC COMPANY,** CHICAGO,

Thames and Greenwich Streets.
**London, Antwerp, Berlin, Paris.**

227-275 S. Clinton St.,
242-258 S. Jefferson St.,
37-45 W. Congress St.

Never Fails to Please.

# SEND 100 PENNIES

—FOR—

# Six Months' TRIAL

OF THE

# WESTERN ELECTRICIAN,

SUITE 510 MARQUETTE BLDG., CHICAGO.

# THIS ALTERNATING CEILING FAN WORKS.

**We Guarantee It.**

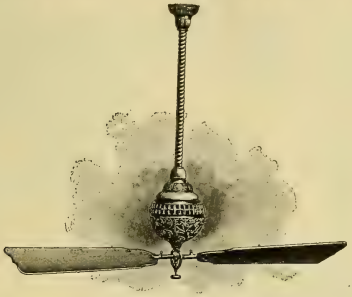
**No Commutator.**

**No Brushes.**

Uses Less Current than any Fan on the Market.

• • •

OUR DIRECT CURRENT FAN WORKS.



## Our Guarantee is Good.

Only Fan having Blade Adjuster.
Air can be thrown UP or DOWN.
All Bearings SELF-OILING.

• • •

Ask for New Catalogue and Discounts, and you will send us an order.

The Handsomest Fan ever offered to the trade.

Fans Finished in Bronze, Nickel and Polished Brass.
We manufacture a full line of Belt Fans and Water Motors.

**AGENTS WANTED IN LEADING CITIES.**

## Tuerk Water Meter Co.,

**FULTON, N. Y.**

E. B. Latham & Co., Agents, 136 Liberty Street, New York.

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# Sprague Electric Elevator Company,

**Postal Telegraph Building, New York City,**

**BUILDERS OF**

## Electric Passenger and Freight Elevators.

**The Multiple Sheave Screw Machine** Duplicates Hydraulic Service with less than half the water evaporation and coal expenditure.

It has any required speed and capacity. Each machine is an independent unit. Like parts are interchangeable. It has a superior down start. It occupies less space. It is absolutely safe.

**The Worm Gear Drum Machine** is for all classes of intermediate service. It is the most perfect machine of its type built.

**The Automatic House Elevator** is absolutely safe. It requires no operator.

Among typical buildings adopting Sprague Machines are:

Postal Telegraph Building, New York City; Parrott Building, San Francisco; Board of Trade, Chicago; Guaranty Building, Buffalo; Syndicate Building, New York City; Union Trust Building, Detroit; Gerken Building, New York City; Custom House, New York City; Merchants' National Bank, Baltimore; Hotel Walton, Philadelphia; J. T. Williams Office Buildings, New York City; Mabley Building, Detroit; Young Men's Christian Association, New York; Daniells' Stores, New York; Court House and City Hall, Minneapolis; Boston Daily Globe, Boston; Safe Deposit Building, San Francisco; Academy of Music, San Francisco; Canada Life Insurance Co., Montreal; State Mutual Life Assurance Co., Worcester; Johns Hopkins University, Baltimore; Edison Electric Illuminating Co., New York; Currier Bank Building, Los Angeles; Ahrens Building, New York; Wadsworth Building, New York; The Callender, McAuslan & Troup Company's Department Stores, Providence; the residences of Mr. John Jacob Astor and Mr. George Morgan, New York; City and County Court House, Salt Lake City; Graham Building, New York City; Mutual Benefit Insurance Co., Boston; Government Printing Office, War Department, Washington; Wilcox Building, Los Angeles.

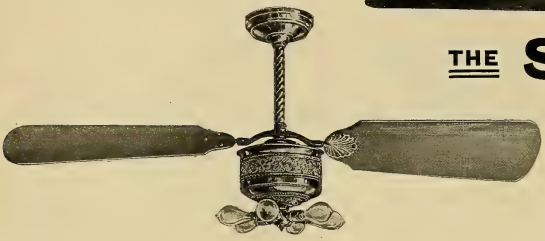
Recent contracts include four of the finest and most costly buildings of their respective classes ever projected:

Manhattan Hotel, 9 Elevators. Siegel-Cooper Stores, 21 Elevators.
Commercial Cable Building, 21 Stories.
Mr. John Jacob Astor's New Palatial Hotel, 19 Elevators.

# LUNDELL ...FAN MOTORS.

SEASON 1896.

THE STANDARD.



20,000 IN ACTUAL USE.

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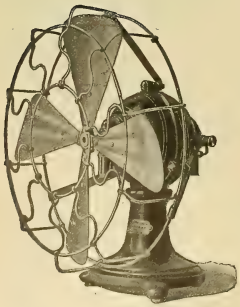

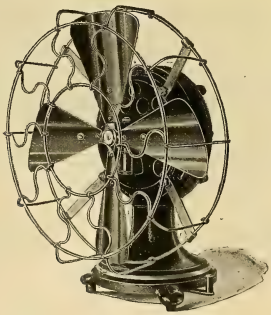

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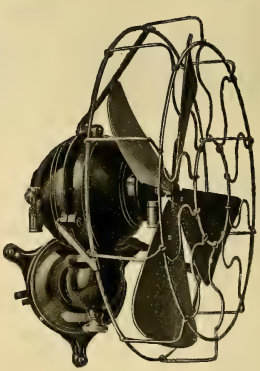

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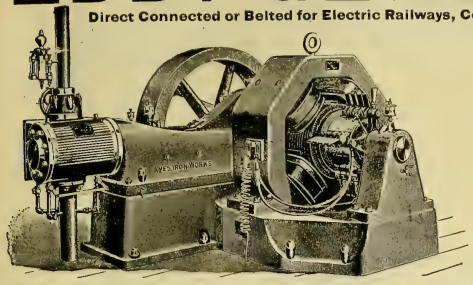

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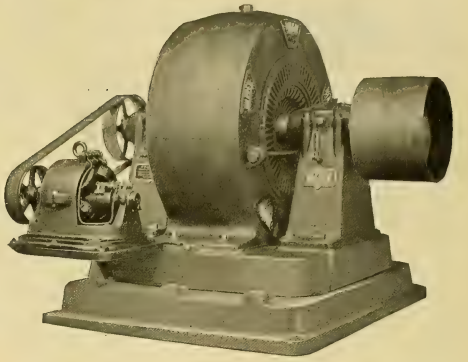

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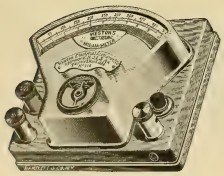

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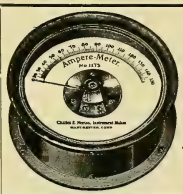


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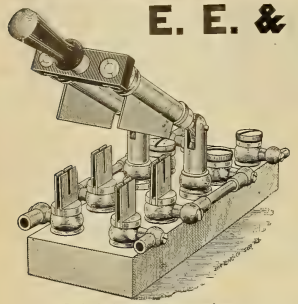

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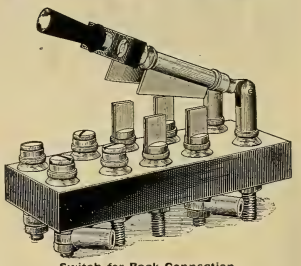

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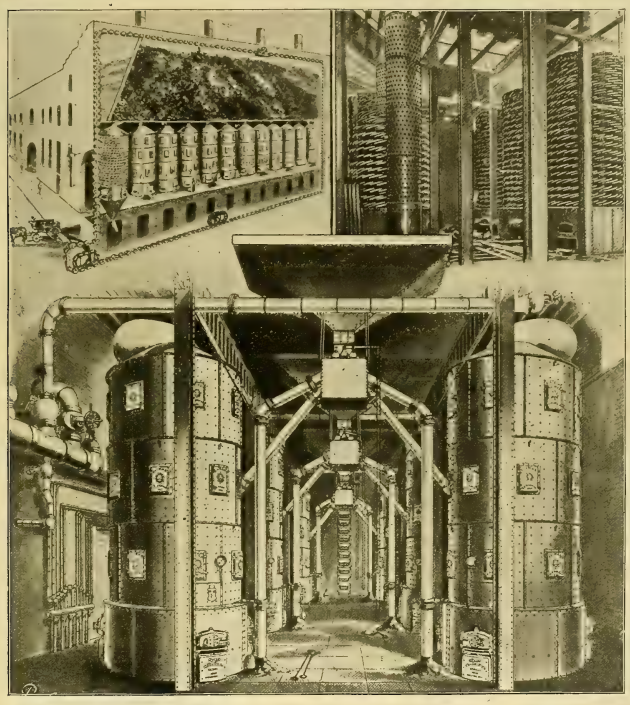

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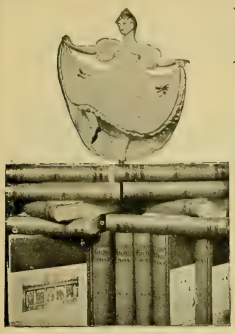

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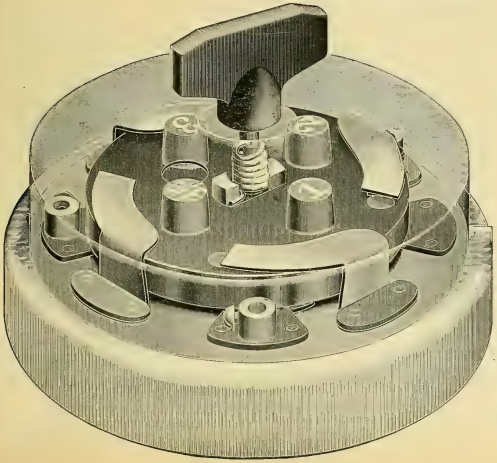

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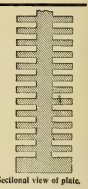

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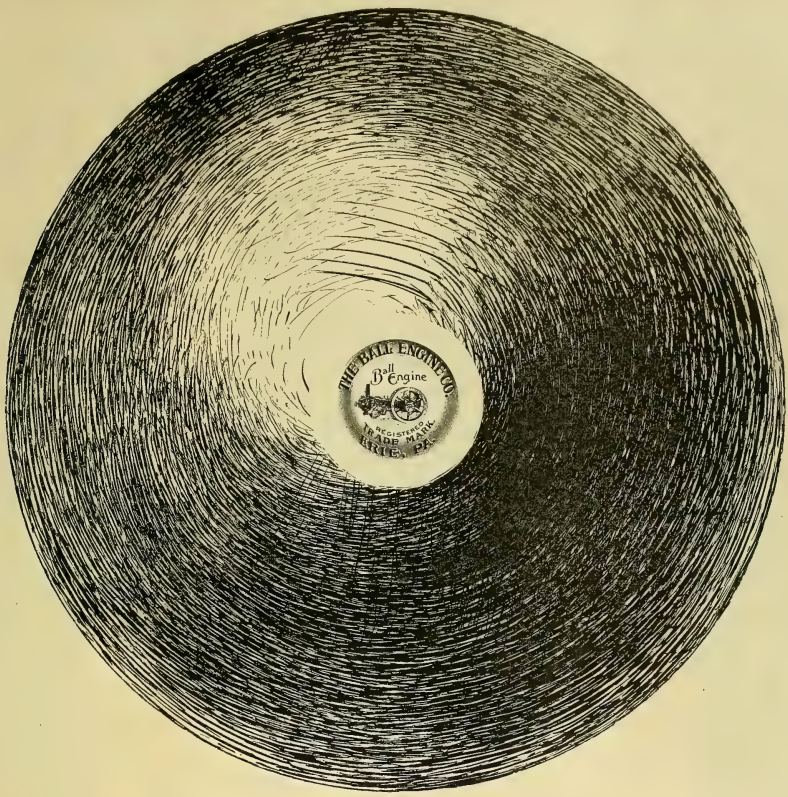


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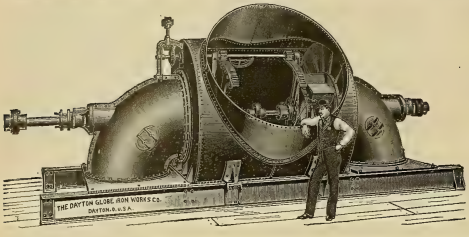


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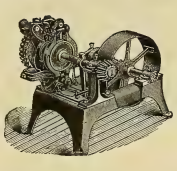

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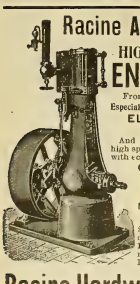

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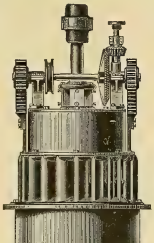

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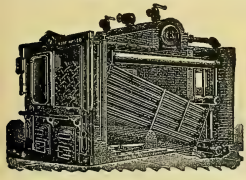

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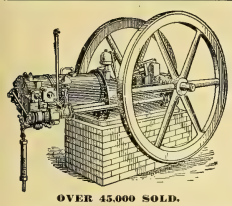

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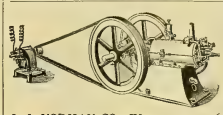

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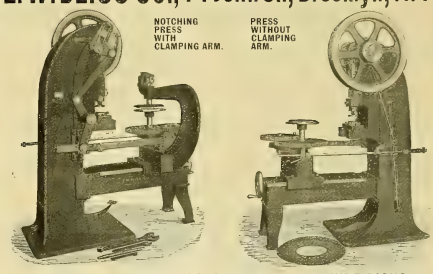


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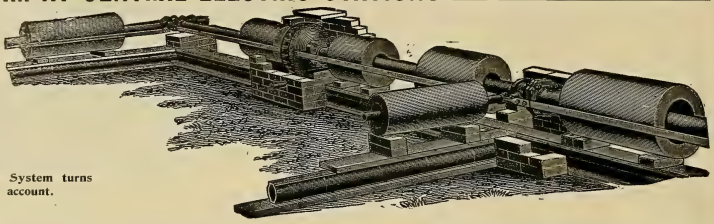

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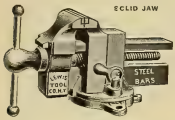


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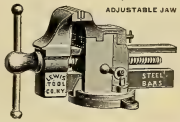


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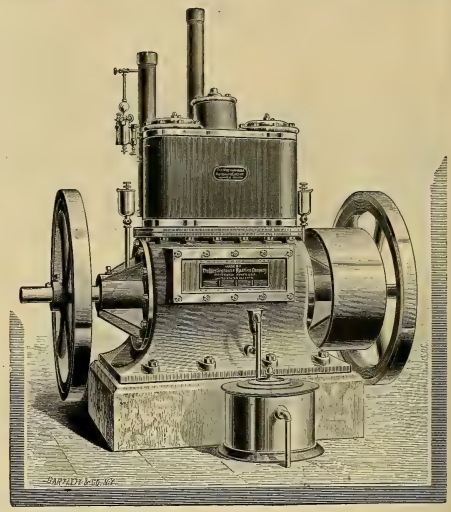

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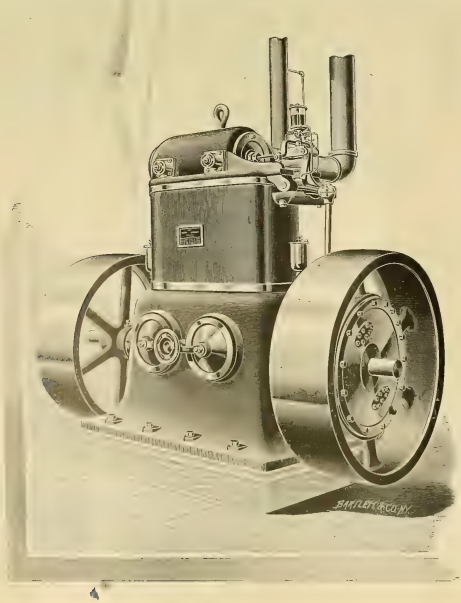
In our business experience we have shipped upwards of 500 engines to foreign countries. This fact means more to domestic buyers than is at first apparent. Handicapped by freights and heavy import duties, we ship to France and Germany, where labor and materials are cheap and machinery of the highest grade is turned out. THIS MEANS QUALITY.

We ship to Spain, Cuba and South America, where fuel is the most expensive. THIS MEANS ECONOMY.

These engines are located from four to twelve thousand miles from our shops, where a breakdown would be an untold inconvenience. THIS MEANS RELIABILITY.



These qualities will be found just as desirable in the United States as at the Antipodes.

In connection with our Export trade, it is interesting to note that the chief office of our agent for the Argentine Republic is in Great Britain, the home of low-priced manufactures. This emphasizes our point that the Westinghouse Engine sells, not on price, but on merit.

We invite the most critical inspection of our product, and methods of manufacture. Our shops are open at all times to engineers and others interested in steam power.

..THE..

# Westinghouse Machine

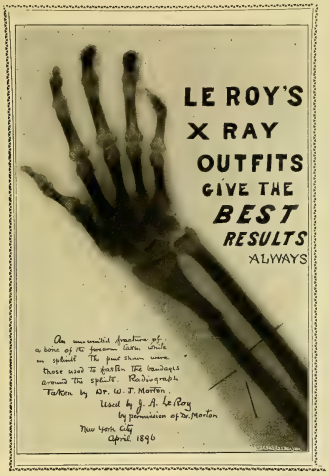
COMPANY,

Pittsburg, Pa., U. S. A.

# = LE ROY'S =

# X RAY OUTFITS.

Portable X Ray Outfits, Crookes Tubes.




Low Price. High Quality. Guaranteed Goods.

## LEROY'S {Improved / Aluminum} X RAY FLUOROSCOPE,

Four times as sensitive as any yet made.

Weight Six Ounces.

Send Stamp for Circular.

## J. A. LE ROY,

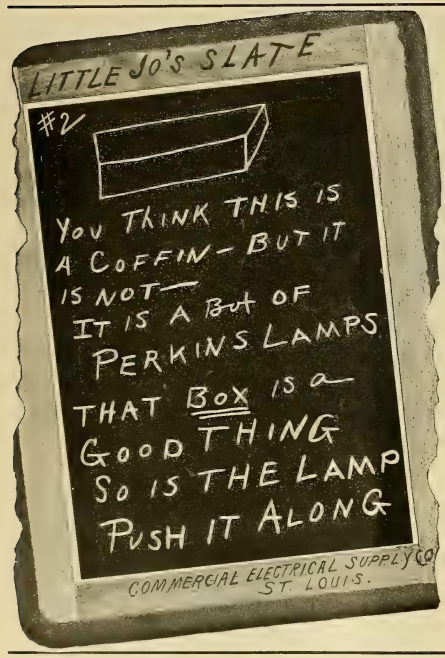
143 East 13th St., - NEW YORK.

# RUBBER BATTEN.

Especially adapted for electric light engines, street railway use and other various electrical purposes.

## WILLIAM H. SCHEEL,

**78 Pine Street, - - - - - New York.**




## ELECTRIC SELECTOR & SIGNAL COMPANY,

**43 CORTLANDT ST.,**

**NEW YORK CITY,**

**MANUFACTURERS OF**

## Automatic Cut-Outs,

**TELEGRAPH SELECTORS,**

**Police and Fire-Alarm Signals.**

Experimental and Repair Work of all kinds by best workmen and with most approved tools . . . .

**Give Us a Call.**

# BARGAINS.

**We have for sale cheap a large amount of second-hand Electrical Apparatus, consisting of**

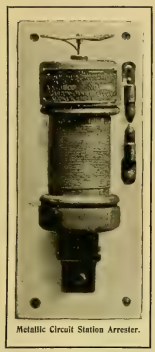
**Alternating Current Generators and Transformers,**
**Direct Current Generators and Motors,**
**Series Arc Machines and Lamps.**

**If you want something CHEAP and good value for the money, write us. They have got to be sold.**

## WALLACE ELECTRIC CO.,

**305 DEARBORN ST., CHICAGO, ILL.**

# Did You Ever Think of It This Way?



Metallic Circuit Station Arrester.

When you buy a dynamo or an engine you of course buy the best. Why not pay the same attention to the seemingly insignificant Lightning Arrester equipment?

## When You Buy Garton Lightning Arresters

### You Buy the Best!

No grounds caused by high ohmic resistance breaking down after a few discharges.

No fuses to replace. No fuse magazines being emptied just too soon for that last discharge!

No light copper balls to melt!

No attention required; always ready.

The Garton St. Ry. Station Arrester.

**Garton Arresters are made for the Protection of**

- Street Railway Power Stations,
- Street Railway Lines,
- Street Railway Cars,
- Electric Light Central Stations and Transformers,
- Stationary Motors and Isolated Plants of all kinds.

**They have lately been adopted by many of the leading manufacturers of Electrical Apparatus.**

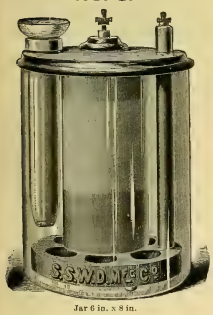
**For Prices or any Information Write to your Supply Dealer, or to**

## GARTON-DANIELS ELECTRIC CO.,

*KEOKUK, IOWA, U. S. A.*

# THE PARTZ ACID GRAVITY BATTERY

NO. 3.




Jar 6 in. x 8 in.
**E. M. F., 1.9 to 2 Volts. Current on short circuit, 1 to 2 Amperes.**
**PRICE, $1.50 PER CELL.**

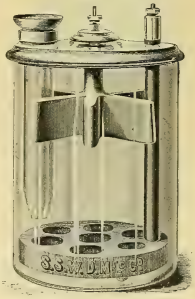
## FOR ALL OPEN CIRCUIT WORK.

**The Highest Voltage, Strongest and Longest Lasting Battery in the World.**

**Awarded Medal and Diploma at Columbian World's Fair, after Competitive Tests.**

**FOR** { Heavy Electric Bell Work, Annunciators, Open Circuit Electric Signals, Electric Clocks, Watchman's Clocks, Long-Distance and Continuously-Used Telephones, Etc., Etc.

NO. 4.




Jar 6 in. x 8 in.
**E. M. F., 1.9 to 2 Volts. Current on short circuit, 3 to 5 Amperes.**
**PRICE, $1.50 PER CELL.**

## ...PARTZ SULPHO-CHROMIC SALT...

**For Use in Partz Acid Gravity Batteries, and for Making ELECTROPOION FLUID. Economy, Safety, Efficiency.**

Sulpho-Chromic Salt, when dissolved in water, makes a standard electropoion fluid without the necessity of handling liquid acids, having practically the same amount of stored energy as an equal quantity of fluid made in the ordinary ways, giving with a zinc carbon element an E. M. F. of 1.9 to 2 volts, and an ampere-hour capacity of about the same.

We specially call the attention of battery-users to this substance as affording the best, cleanest and most convenient method of making electropoion fluid for medical batteries, Grenet Cells, Bunsen batteries, for lecture-tables, experimental work, etc., and motor batteries.

Sulpho-Chromic Salt is put up in air-tight jars with screw lid, each jar containing two pounds. As the salt is hygroscopic, it must be guarded against moisture. **Price, per Jar, 2 lbs., $0.75.**

The attention of Architects, Contractors, Builders, Dealers in Electrical Supplies, Telephone Companies, etc., is called to this Battery.

**SEND FOR CATALOGUE.** Many of the large Hotels throughout the country are now replacing unsatisfactory batteries with the PARTZ ACID GRAVITY BATTERY. **We make also Electrical Outfits for Dentists. Send for prices and descriptions.**

## THE S. S. WHITE DENTAL MFG. CO.,

Chestnut Street, Cor. Twelfth St., Philadelphia, Pa.
NEW YORK, BOSTON, CHICAGO, BROOKLYN, ATLANTA.

# Contracts for Storage Batteries

HAVE RECENTLY BEEN CLOSED WITH

THE EDISON ELECTRIC ILLUMINATING CO. OF NEW YORK (2d Plant),
THE EDISON ELECTRIC ILLUMINATING CO. OF BROOKLYN,
THE HARTFORD ELECTRIC LIGHT CO.,

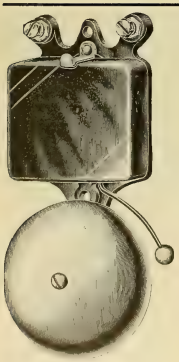
BY

## The Electric Storage Battery Co.,

DREXEL BLDG., PHILADELPHIA, PA.

*BRANCH OFFICES:*

66 Broadway, New York.
1543 Marquette Bldg., Chicago, Ill.
215 North Calvert St., Baltimore, Md.
15 First St., San Francisco, Cal.
333 Exchange Bldg., Boston, Mass.



Styles L. R. H.

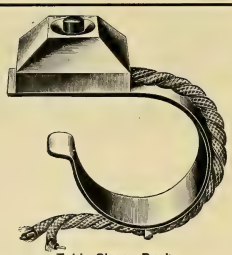
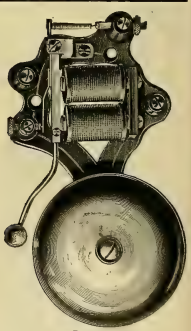


Table Clamp Push.



Style F.

If you want **BELLS** that RING,
If you want **PUSHES** that PRESS,
If you want **SWITCHES** that CONNECT,
If you want **TABLE CLAMPS** that HOLD,
...OR...
If you want **ANYTHING RELIABLE** in this line, see or write

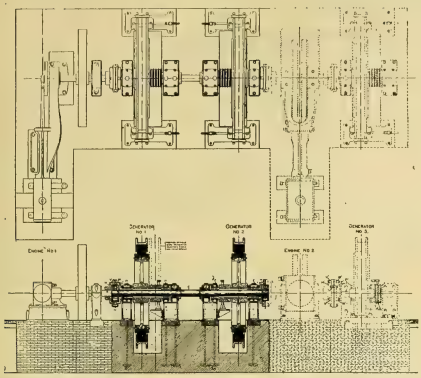
No. 49.

HUEBEL & MANGER,
MANUFACTURERS OF
ELECTRICAL AND BRASS GOODS
ANNUNCIATORS, BELLS, BRONZE PUSHES &c.
286-290 GRAHAM ST.
BROOKLYN, N.Y.

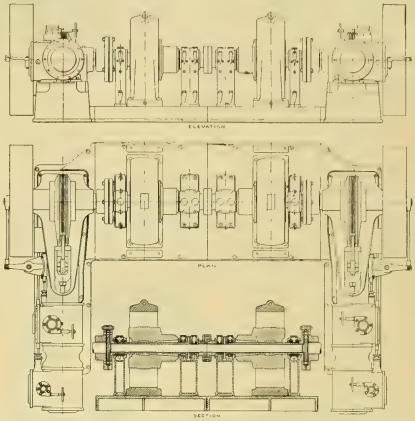
Style C.

# "Arnold System."

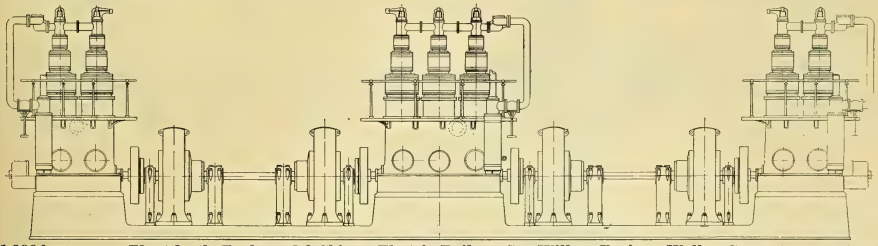
## Less First Cost, Less Real Estate Required, Lower Operating Expenses, Greater Reliability.



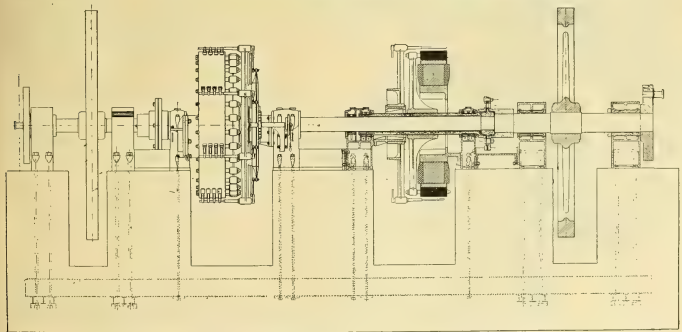
**500 horse power Plant of Ft. Dodge Light & Power Co., Ft. Dodge, Ia. In successful operation since July 1, 1895. Nordberg Corliss Engines, General Electric Monocyclic Generators, 120 revolutions per minute.**



**300 horse power Plant for Chicago Board of Trade. Ames Engines, Westinghouse Generators, 275 revolutions. Now under construction.**



**1,000 horse power Plant for the Englewood & Chicago Electric Railway Co. Willans Engines, Walker Generators, speed 380 revolutions. Now under construction.**



**1,000 horse power Plant for the Suburban Railroad Co., Chicago. Providence Green Engines, Siemens & Halske Generators, 100 revolutions. Now under construction.**

This company owns U. S. patents issued to B. J. Arnold for "Improvements in Electric Power Station Construction," one claim of which reads as follows: "The combination of a series of dynamo electric machines, with a main driving shaft and rotating parts for each dynamo electric machine supported on a hollow sleeve surrounding the main shaft and journaled in independent bearings, with clutch mechanisms (positive, friction or magnetic), whereby such rotating part or sleeve may be positively connected to the shaft at will."

We are prepared to build electric power stations complete, using any make of engines, generators or boilers desired by the purchaser, and give greater reliability in operation for less first cost than is possible with independent direct-coupled units.

# ARNOLD ELECTRIC POWER STATION CO.,

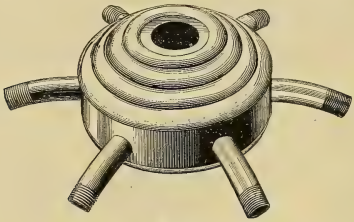
SUITE 1540
Marquette Building
CHICAGO.

# A PAGE FROM THE

# E. P. GLEASON MFG. CO.'S CATALOGUE.

## Are You Interested?



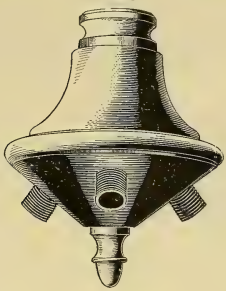


E. 489½.

E. 489½

**Standard Separable Box Cluster.**

| | | | |
|---|---|---|---|
| 2 | Light | each, | $0 75 |
| 3 | " | " | 88 |
| 4 | " | " | 1 00 |
| 5 | " | " | 1 12 |
| 6 | " | " | 1 25 |
| 8 | " | " | 1 50 |
| 10 | " | " | 5 63 |
| 12 | " | " | 7 50 |



E. 489 A.

E. 489 A.

**Shell Cluster.**

SEPARABLE.

| | | | |
|---|---|---|---|
| 2 | Light | each, | $0 75 |
| 3 | " | " | 88 |
| 4 | " | " | 1 00 |
| 5 | " | " | 1 14 |
| 6 | " | " | 1 25 |

E. 474.

E. 474

**Cluster Ball with Nipples.**

TAPPED TO FIT ANY SIZE PIPE.

| | | | |
|---|---|---|---|
| 2 | Light | each, | $0 35 |
| 3 | " | " | 40 |
| 4 | " | " | 45 |
| 5 | " | " | 50 |
| 6 | " | " | 55 |

E. 474 A.

E. 474 A.

**Competition Cluster Ball.**

| | | | |
|---|---|---|---|
| 2 | Light | each, less nipples, | $0 50 |
| 3 | " | " " " | 25 |
| 4 | " | " " " | 30 |
| 5 | " | " " " | 35 |
| 6 | " | " " " | 44 |

**Nipples.**

Per gross.....$5 00

## E. P. GLEASON MFG. CO.,

Cor. Houston and Mercer Sts., - - - New York City.

# WE WANT MORE GOOD AGENCIES.

## THREE LETTERS TO THE ELECTRICAL PUBLIC:

# P. E. C.

**FIRST.**

**To Our Dear Friends, the Manufacturers:**

*Gentlemen:* We are Western Electrical Supply hustlers, having only time enough to handle the best articles made for the purpose intended.

Experience has taught us that central station men are past the age of experimenting.

Have you got a good article? Do you want it properly placed before interested parties? We guarantee **push, ability, capital, personal solicitation, square dealing and success.**

Electrically yours,
**People's Electric Co.**

P. S.—No time for cheap stuff.

• • • •

**SECOND.**

**To Our Very Dear Friends, Our Past, Present and Future Customers:**

*Gentlemen:*—We know you are a busy people, over-worked, and therefore, to make a long story short, beg to say that we handle only what our personal experience with you has taught us to be of greatest practical value. You, the scholars of the past, are the teachers of to-day.

Our stock is made up of those articles best adapted to your wants. We guarantee **correct interpretation of your orders, prompt attention, personal attention, quick dispatch, clean goods properly packed, invoices correctly made.**

Your Electrical Servants,
**People's Electric Co.**

**THIRD.**

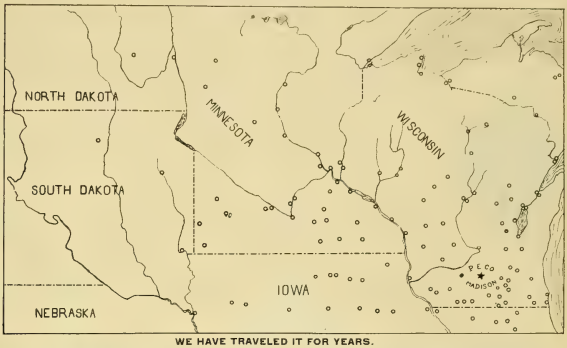
**To Our Business Friends:**

THE PEOPLE'S ELECTRIC CO. was organized and incorporated under the State Laws of Wisconsin for the purpose of dealing in all kinds of electrical supplies. We are qualified by experience in the shipping room, the counting room, on the road, in the central station, in the university and in practical installation.

Our aim is to improve the electrical business in all its various branches and do our part in placing it in the foremost rank of commercial enterprises. Our success has been beyond our expectations, due to the confidence of our **business friends.**

Very respectfully yours. **People's Electric Co.**

**OUR TERRITORY.**




**WE HAVE TRAVELED IT FOR YEARS.**

# PEOPLE'S : ELECTRIC : COMPANY,

**We are selling goods manufactured by**
Wagner Electric Mfg. Co., St. Louis.
Columbia Incandescent Lamp Co., St. Louis.
H. T. Paiste Co., Philadelphia.
W. C. Vosburg Mfg. Co., Brooklyn.
Northern Electrical Mfg. Co.

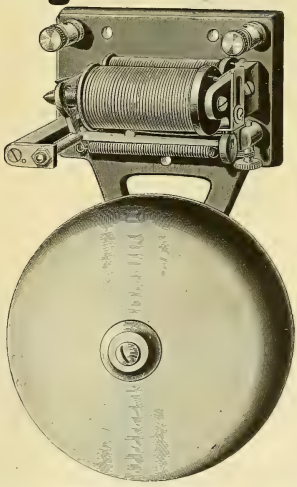
The Electrical Supply House of the Northwest,
MADISON, WIS., U. S. A.

**We are selling goods manufactured by**
Western Electric Co.
New York Insulated Wire Co.
Bryant Electric Co.
Anchor Electric Co.
Standard Telephone & Electrical Co.
And others of equal prominence.

**DO YOU WANT THE SERVICES OF RELIABLE WESTESN HUSTLERS?**

# The Vigilant Single Stroke OR VIBRATING ELECTRIC BELL.

THE ONLY PERFECT SIGNAL BELL.



FOR RAILROADS, DEPOTS, FACTORIES, FIRE ALARM, Etc.

Our 1896 Catalogue Is Ready.

....ASK YOUR SUPPLY HOUSE FOR IT OR SEND TO....

# EDWARDS & CO., 144TH STREET AND 4TH AVENUE, NEW YORK.

# AT THE NEW YORK EXPOSITION

Can be seen some of our new and improved specialties, among which is our SOLID FLUSH PLATE SWITCH, on which the plate is always tight.

Also our new Push Button Switch, which is acknowledged to be the best on the market.

SNAP SWITCHES, all styles and sizes.
CUT-OUTS—Mains, Branches and Ceiling Cut-Outs.
SOCKETS, now so cheap.
RECEPTACLES, Concealed, Shade Holder and Cleat.
GONGS, WATCHMAN'S REGISTERS, DOW ADJUSTERS.

## ANCHOR ELECTRIC CO.,

New York Office: 26 Cortlandt Street.

71 FEDERAL ST., ... BOSTON ...

Chicago Office: 1654-5-6 Monadnock Blk.

## ELECTRICITY

Mechanics; Architectural Drawing and Designing; Architecture; Mechanical Drawing; Steam Engineering (Stationary, Locomotive or Marine); Civil, Railroad, Bridge, Hydraulic and Municipal Engineering; Plumbing and Heating; Coal and Metal Mining; Prospecting, and the English Branches.

Until further notice experimental apparatus will be furnished *free* to students. Send for Free Circular and Book of Testimonials, stating the subject you wish to study, to

The International Correspondence Schools, Scranton, Pa.

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Will find that the WESTERN ELECTRICIAN can help them wonderfully in the study of electricity. Subscribe now. $3.00 per year, in advance.

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## FUSE WIRE AND LINKS FOR ALL SYSTEMS.

Correct Carrying Capacity. Absolutely Uniform.

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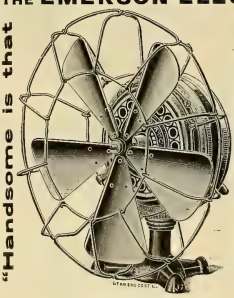
153 Lake St., Chicago.

## THE EMERSON ELECTRIC MFG. CO.,

ST. LOUIS, MO.,
And 112 Liberty St., New York.

"Handsome is that Handsome does."



TYPE E. I. 1.

## NOTE THIS

Current Consumption:

"Meston" 12-inch fan, 60 to 70 watts.
" 16-inch fan, 70 watts.
Induction 12-inch fan, 7,200 alts., 80 to 90 watts.
Induction 16-inch fan, 7,200 alts., 110 to 125 watts.
Induction 12-inch fan, 16,000 alts. 90 to 100 watts.

CHEAPEST

Fan Motors on the market because BEST.

## THE FLEMING ALTERNATING ARC LAMP...

Simplest, Neatest and Best Working Lamp on the Market.

New Catalogue Just Out.

Agents Wanted In Leading Western Cities.....

Our Prices are Right.

**FLEMING-SPENCE ELECTRICAL CO.,**
652 Hudson St., New York.

72 PAGES

72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES 72 PAGES

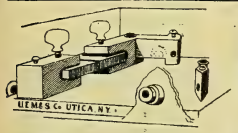
72 PAGES

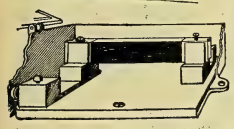
Was it not a beauty?
Just think of it!
72 Advertising Pages!
288 Advertising Columns!
3,744 Column Inches!
7,576 Square Inches of
Paid Advertising Matter in
The Western Electrician's
Special Convention Number
For May 9th (last week).
40% Increase over last year's
Cleveland Convention Number,
When 52 Pages and 5,593
Inches were published.
What about the hard times,
Eh? Some people are going
Ahead just the same, and
These Advertisers and
The Western Electrician
Are among them.
Get in line for the big
Increase of business
Which is surely coming.
Send in your order for
A Page or Half Page, or for
A regular Card, and
Get before the People
Who buy goods.
You know where we are,
510 Marquette Bldg., Chicago.

40% INCREASE

40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE 40% INCREASE

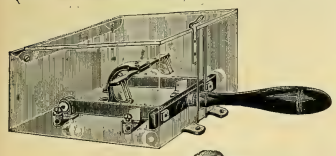
40% INCREASE

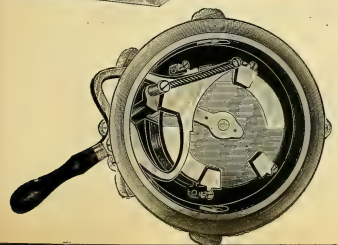


THESE ARE ONLY A FEW

Of the "good things" we have for users. Correspond with us, it will pay you.





UTICA ELECTRICAL MFG. & SUPPLY CO.,

UTICA, NEW YORK.

THE

UNITED ELECTRIC IMPROVEMENT CO.

OFFICE AND WORKS:

*19th St. and Allegheny Ave., PHILADELPHIA, PA.*

New Discounts on Standard Series Incandescent Lamps For all Systems and for any Current, Candle-Power or Base.

*TRIAL ORDER SOLICITED.*

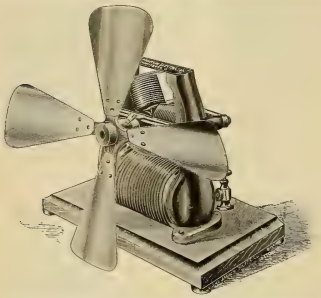
**Alternating Current Generators, Transformers, Motors, Arc Lamps and Switchboard Equipment for Central Stations.**

*WRITE FOR DESCRIPTIVE CATALOGUE.*

**Multipolar and Bipolar Direct Current Dynamos and Appurtenances for Isolated Plants.**

**Improved Long Distance Series Incandescent Apparatus and Supplies.**

CORRESPONDENCE SOLICITED. SATISFACTION GUARANTEED.



# "Franklin" Battery Fan Motor Outfits.

No. 5 Motor, complete with 10-inch fan, wound for 4, 6, 8 or 10 volts, price $ 7.50.
No. 5 Motor, wound for 110 volts, with either 10 or 12-inch fan - - 10.00
No. 5 Outfit, consisting of one No. 5 Motor with fan, two No. 6 Motor batteries with one charge of solution which will run motor 160 hours, price, complete outfit - - - - - - - - - - - - 18.00
Wire fan guard, extra - - - - - - - - - - - - - 1.00

**The Motor** is guaranteed first-class, nicely finished and efficient. We furnish either four or six blade fans, as desired.

**The No. 6 Battery** is something new and will produce a current of electricity equal to a dynamo current for motive power at a less cost than charged by established light and power companies or any other primary battery on the market. It is easily maintained, solution costs about 30 cents per cell to recharge. It is furnished in a concentrated form, requiring nothing but the addition of six times its bulk of water. **See circular for full information.**

Battery complete, hard rubber cell 7x7x9 in hes, 1,000 ampere hour capacity, price $6.50.

**Send address for descriptive circulars or two 2-cent stamps for catalogue.**

**FRANKLIN ELECTRIC AND MANUFACTURING CO.,**
**MIAMISBURG, OHIO.**

# *JUST NOW*

Is the time to decide on the Fan Motor you intend to handle this season. Our direct current motor is equal to the best, if its intrinsic merit is considered.

## Annunciators, Medical Farradic Batteries.

MAGNETO, HAND AND POWER

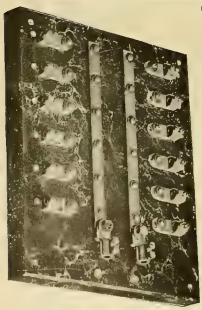
**...GENERATORS...**

**INDUCTION AND SPARK COILS, ETC., ETC.**

**WRITE FOR CATALOGUE**

## Menominee Electrical and Mechanical Co.,

**MENOMINEE, MICH.**



# TABLET BOARDS, SWITCHES AND SWITCHBOARDS

**of all descriptions.**

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Formerly J. Grant High & Co.,
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**BRANCH OFFICES:**
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**Yes!** When purchasers duplicate orders as they do for our

## Worrall Improved Friction Clutch System, Cut-off Couplings, Pulleys and Quills.

**Turned Iron Shafting,**
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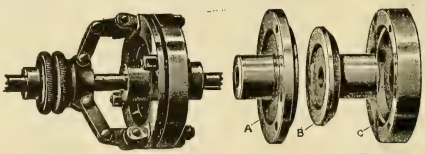
**Improved Vertical Belt Tightener.**

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**Everything new in the line of Specialties....**

We have everything used for Transmission of Power in Electric Light and Power Stations or Isolated Plants. **WRITE US FOR ESTIMATES.**

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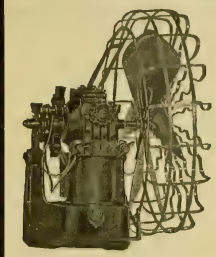


## *LOTS OF OTHER FAN OUTFITS*

# BUT ! ! !

The C-W FAN OUTFITS have 6 BLADE, 12 and 16-INCH FANS instead of the usual 10 and 15-inch 4 Blade.

They will therefore do **BIG WORK** if you want it.

The Fan guard is ornamental and substantial and close enough mesh to prevent a Fan blade from flying out should it, by chance, be broken while in operation.

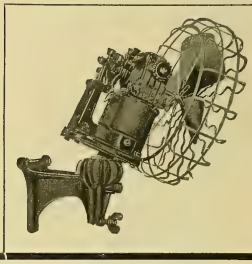
The complete Fan Outfit may not address itself to your eye as pleasantly, as to design and shape, as some others, it having been considered unwise to sacrifice stability to enhance its appearance.

If you want a Fan Outfit for this season and will want it again next season, and several following seasons, you want the **C-W.** Let our Selling Agents talk to or write you.

## *Crocker-Wheeler Elec. Co.,*

MANUFACTURERS AND ELECTRICAL ENGINEERS,

**39 and 41 Cortlandt St., New York.**



WE tell you here only about FANS. This is the FAN SEASON. We also manufacture "The Best" in Dynamos and Motors of Standard and Special Types in all practical sizes. If interested in these please write us. . . . . .

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No. 1 Plate for 5 and 10 Amp. Hart Switches.

# HART FLUSH SWITCHES.

New Face Plate.

## BETTER PROPORTIONS. BETTER FINISH. MORE DURABLE.

Made of solid plate brass $\frac{1}{8}$-inch thick, with beveled edges.

Better Design,
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Self-Adjusting Handle,
No Breaking,

No Binding on Face Plates,
No Loose Face Plates.
Handles, Switches and Face Plates Interchangeable.

Single Plates for all sizes of Hart Switches.
Gang Plates for any number of Hart Switches.

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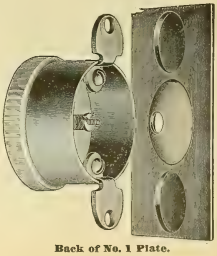
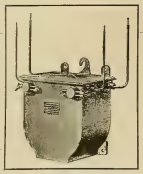


Back of No. 1 Plate.

## THE HART & HEGEMAN MFG. CO., HARTFORD, CONN.

# HOLD ALL RECORDS

FOR Efficiency AND Regulation.



FOR Economy AND Indestructibility.

## PACKARD TRANSFORMERS.

GENERAL WESTERN AGENTS.

**Electric Appliance Company,**

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# PERFECT INSULATION

Can only be Secured by the use of . . . **P** and **B** Compound, Varnish, Tape, Paper.

**Are You Acquainted With Them?**

IF NOT, WRITE FOR PARTICULARS TO

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METROPOLITAN ELECTRIC CO., 186-188 Fifth Ave., . . . CHICAGO.

PEERLESS SPIRAL PISTON & VALVE ROD PACKING

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## PEERLESS SPIRAL Piston and Valve Rod PACKING

Expressly for High Speed Engines. Will Hold 400 lbs. Steam.

**20 YEARS OLD AND NO EQUAL.**

Manufactured Exclusively by

**PEERLESS RUBBER MFG. CO.**

16 Warren Street, NEW YORK.

¼ to 2 inch diameter. In Boxes 3 to 8 lbs.

## The NORTHERN ELECTRICAL MFG. CO.,

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MANUFACTURERS OF

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**Our machines will operate SUSPENDED from CEILING OVERHEAD or BOLTED DIRECT to SIDE WALL as readily as when occupying floor space in the ordinary manner. All bearings self oiling. See our new patented device for CONNECTING MOTORS DIRECT TO LINE SHAFT, SAVING BELTS, PULLEYS AND FLOOR SPACE.**

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INVERSE TIME ELEMENT

C-S FLUSH SWITCHES

AUTOMATIC MAGNETIC

## CIRCUIT BREAKERS

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For Arc Light and Trolley Cord.

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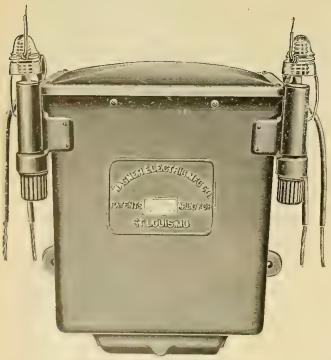
# TRANSFORMERS.

## NOT THE CHEAPEST TO BUY, BUT THE CHEAPEST TO OPERATE.



800 Light Type "D" Transformer.

**OUR CLAIMS** for efficiency and regulation have been **SUBSTANTIATED** by tests made all over the country, and we have received many letters from college professors congratulating us on the **REMARKABLE RESULTS** of tests made by them on our transformers.

We were the first to recommend the purchase of transformers on definite specifications, and to send to purchasers diagrams and full information showing proper methods for transformer testing.

We have courted and **ENCOURAGED COMPARATIVE TESTS,** knowing that our competitors alone had cause to fear them. It is said that

## ....IMITATION IS THE SINCEREST FLATTERY....

Compare the recent advertisements and circulars of several competitors with our advertisements of two years ago. **NOTE THEIR CLAIMS.** We have forced them to make these. We are now forcing them to prove them, which we know full well they will fail to do. We challenge any manufacturer to equal our efficiency and strength of insulation.

Our **PHENOMENAL SUCCESS** has rendered our present factory entirely inadequate to supply the demand for our apparatus. We are now building **A NEW FACTORY FOUR TIMES THE SIZE** of our present one. When this is completed we **HOPE** to be able to fill all orders more promptly.

**Transformers of Any Size.**

**Transformers of Any Voltage to 25,000 Volts.**

**Transformers of the Highest Possible Efficiency.**

**Remember, Efficiency affects your Coal Pile. The cheapest Transformer is sure to prove the most expensive in the end. . . . . ,**

# Wagner Electric Manufacturing Company.

GENERAL OFFICES AND FACTORY AT ST. LOUIS, U. S. A.

AGENCIES: BOSTON, 620 Atlantic Avenue. PHILADELPHIA, 1000 Betz Building. CHICAGO, 1236 Monadnock Block. SAN FRANCISCO, 35 Market Street. MADISON, WIS., 233 King Street. TORONTO, CAN., W. A. Johnson Electric Co.

STORE ROOMS: Boston, Philadelphia, San Francisco, St. Louis.

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy.

# AMERICAN ELECTRICAL WORKS,

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BARE AND INSULATED ELECTRIC WIRE,
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All Kinds OF MICA.

# The Only Water-Wheel Governor that Governs.

Montague Street Railway Co.

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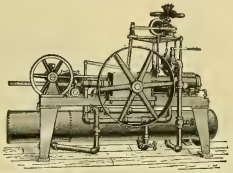
LOMBARD WATER-WHEEL GOVERNOR CO.,
61 Hampshire Street, Boston, Mass.

GENTLEMEN:—We have one of your Governors in use at our power house at Millers Falls, Mass., taking care of two water-wheels to perfection, regulating the power *within a few volts*. We took out one Governor and replaced it with a LOMBARD GOVERNOR which gives *perfect satisfaction*. Yours truly, MONTAGUE ST. RY. CO.,
(Signed) H. C. GARFIELD, Supt.



Sold on trial and absolutely guaranteed to hold wheel speed to satisfaction of purchaser, irrespective of sudden changes of load.

Send us a description of your water-wheel plant.

LOMBARD WATER-WHEEL GOVERNOR CO.,

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OUR ALTERNATING
Current Ammeters
....AND....
VOLTMETERS

FOR SWITCH-BOARD WORK

are superior to anything on the market, and our prices—well, write to us and we will tell you all about them.

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Long Life, Economy, Safety, Convenience, VOLTAK.
A Dry Soluble Compound for all ZINC CARBON BATTERIES.
Prominent Telephone Companies after testing the Compound have adopted it. Costs about one-half as much as the solution.
Saves labor and expense of carting dangerous liquids to the different terminals.
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(PATENTED FEB. 26, 1895.)
Cheapest and Best Covering on the Market.
PREVENTS SLIPPING OF BELTS.
Fully Guaranteed. Send for our Catalogue.
MANUFACTURED BY
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804-805 GAFF BUILDING 230-236 LA SALLE STREET.

Gordon Primary Battery
EXCELS IN
Long Life, Efficiency,
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It is absolutely Non-Freezing.
Labor Saving,
Free from Local Action,
Freedom from Gases and Odors.
Superior Generation of Energy.

These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America.
Send for descriptive circular and price list. We guarantee all our Cells.

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The Gordon-Burnham Battery Co.,
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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

AGENCIES:
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ELECTRICAL ENGINEERING CO., MINNEAPOLIS, MINN.
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# Phillips Insulated Wire Co.,

NEW YORK OFFICE: 39 and 41 Cortlandt St.
FACTORY: Pawtucket R. I.

## WANTED.

A first-class electrician and superintendent. One who understands the management of men and has had practical experience in both. Must have a reputation and best of references. State particulars with price. None but the best need apply. Address "Carroll," care WESTERN ELECTRICIAN, Suite 510 Marquette Bldg., Chicago.

## WANTED.

Situation as superintendent of an electric light plant, or combined electric light and water works plant. Have had considerable experience in both. Have held present position over 4 years and only desire to change on account of my wife's health. Am strictly temperate and can furnish best of references as to character and ability. Address "Water Works," care Western Electrician, 510 Marquette Bldg., Chicago.

## WANTED.

Position by young man having had large practical experience with electrical and power machinery, and understands arc light repairing; also experienced in the care of steam plants. Can give good references.

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## CORRESPONDENCE

Is solicited with companies needing the services of a superintendent or manager. Well known references will be named showing an experienced and reliable man. Have successfully operated some of the best plants and will name them as reference. Past record will show that I am thoroughly familiar with repair details and am first-class electrical and mechanical engineer. "Satisfaction," care WESTERN ELECTRICIAN, Suite 510 Marquette Bldg., Chicago.

## POSITION WANTED.

By electrician of technical education and long practical experience in all kinds of testing, calculations, designing and manufacture of instruments, lamps and machinery. Can, if desired, furnish complete equipment of first-class instruments for a laboratory or testing department for all kinds of electrical and photometric tests. Might accept engagement for only part of my time. Address "Practician," care of WESTERN ELECTRICIAN, Suite 510 Marquette Bldg., Chicago.

## For Sale.

4000 rubber storage battery jars; 28 storage battery car motors; 50 ammeters; 5 focusing arc lamps; 1400 incandescent lamps, 48 to 60 volts; two 300 light incandescent dynamos; five 20 arc light dynamos; five 15 arc light dynamos; one 225 volt 90 ampere dynamo; one 250 volt 100 ampere dynamo. New wire of various sizes. Any of above will be sold low or will exchange for old material. WALSH'S SONS & CO., Newark, N. J.

**Bargains in Machinery for Street Railways.**

One 600 h. p. Corliss engine, one 300 h. p. Corliss engine; one 500 h. p. Westinghouse compound engine; one 250 h. p. Ball automatic engine; two 125 h. p. Ball automatic engines; two 80 h. p. Ball automatic engines; two 150 h. p. generators, 500 volts; four 60 h. p. generators, 500 volts; large stock of automatic engines and dynamos of every description. Also a battery of compound boilers, 700 h. p., 160 h. p. in a pair. FRANK TOOMEY, 131 N. Third Street, Philadelphia.

## FOR SALE.

One 1,000 light 2-coil 2-circuit dynamo and one 250 light incandescent. Both direct current, compound wound.

**L. A. HINE & CO.,**
234 E. Lake Street,
CHICAGO.

## FOR SALE.

A 1,900-light Fort Wayne Alternating Incandescent Dynamo, with Exciter. Second-hand, but in perfect order. Address

**THE S. FREEMAN & SONS MFG. CO.,**
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One 25 drop Telephone Switchboard, good as new. Room on board for 50 more drops. Made of cherry in desk fork, with night bell. Cash, $45.00.

**Telephone Exchange,**
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# FOR SALE.

Here are the best machine, and to close out the set and make a quick sale will be sold for

FIVE HUNDRED DOLLARS CASH.

It is a 50 light 2000 Candle Power Arc Dynamo made by the Standard Electric Co. and has the usual accessories. It is now on hand in use and is guaranteed.

Who gets it?

Address CASH.
Western Electrician Office.

## FOR SALE.

1,500 tons 60-lb. relaying rails; 1,000 tons 75-lb. relaying rails; 800 tons 45-lb. relaying rails. 30 electric cars in good order. New electric cars and new and second-hand passenger cars. 50 box and 50 flat cars, 25 tons capacity. Specialty in negotiating electric and steam railroad bonds when payable at Farmers' Loan and Trust Co., N. Y., or Knickerbocker Trust Co., 66 Broadway, N. Y., and printed at an A1 Bank Note Company in N. Y.

**ROLLING STOCK SOLD ON EASY TERMS.**

**A. W. LADD,**
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BROOKLYN, N. Y.

# FOR SALE.

**One 150 Light Mather Incandescent Machine with Spare Armature.**

**One 100 Light Mather Incandescent Machine.**

## FOR SALE VERY CHEAP.

**Practically new, in A1 condition.**

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Care WESTERN ELECTRICIAN, Suite 510 Marquette Bldg., Chicago, Ill.

## To Electrical and Steam Contractors.

Sealed proposals will be received by the State Board of Control of the State of Wisconsin up to 12 o'clock noon of Tuesday, May 26, 1896, for the material and labor necessary for the construction of an electric lighting, steam engine and boiler plant with all necessary appurtenances as per complete plans and specifications on file in the office of the State Board of Control, Madison, Wis., also on file in the office of Charles G. Armstrong, Consulting Electrical Engineer, 1306-1307 Great Northern Bldg., Chicago, Ill.

Bids must be accompanied by a certified check in the sum of 2 per cent. of the amount of the bid, payable to the order of Hans B. Warner, President; to be forfeited to the State of Wisconsin in case the bidder or bidders chosen fail to enter into a contract with the Board, and furnish a satisfactory bond for the proper construction of the same, within ten days after the acceptance of their proposal.

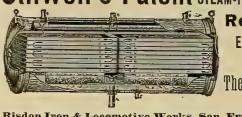
Bids must be sealed and addressed to the undersigned, must be plainly marked on the envelope "Proposals for Engine and Boiler Plant" or "Proposals for Electric Lighting Plant" (as the case may be) for the State Prison, Waupun, Wis.

The State Board of Control reserve the right to accept any bid or combination of bids or to reject any or all bids which the Board may deem to the advantage of the State.

By order of the State Board of Control.

HANS B. WARNER, President.
Madison, Wis., April 29, 1896.

## Stilwell's Patent LIVE STEAM-FEED Water Purifier.



**Removes all Impurities.**

ENTIRELY PREVENTS SCALE IN STEAM BOILERS. Catalogue on Application.

The Stilwell-Bierce & Smith-Vaile Co.,
DAYTON, OHIO.

Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agent.

ESTABLISHED 1880.

W. C. Sterling, Sr. W. C. Sterling, Jr.

## Cedar Poles.

Poles for Railway, Telephone, Telegraph or Electric Light Plants, Standard Norway Pine, Painted Cross Arms and Oak Pins.

Six large sorting pole yards in Michigan. Get prices on first grade poles for city construction and buy of an old reliable firm.

W. C. STERLING & SON, MONROE, MICH.

## C. S. HART,

WHOLESALE

Telegraph, Telephone, Electric Light AND STREET RAILWAY POLES.

Manufactured from Live Cedar peeled. Quick shipments and best quality.

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## INDIA AND AMBER MICA.

Can furnish any size, shape or pattern. Write for samples and quotations.

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## POLES

WHITE CEDAR — Telephone Electric Light, — STREET R. R. AND — STREET CAR TIES.

Write for delivered prices. LINDSLEY BROS., Menominee, Mich.

Write PAUL PERRIZO JR. CEDAR & LUMBER COMPANY, Marinette, Wis. - for prices on

## WHITE CEDAR POLES

before purchasing elsewhere.

## The Brady Mast Arms.

T. H. Brady, New Britain, Conn., U. S. A.,

Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work.—*Catalogues and Prices furnished on application.*

## A. L. LEWIS & CO.,

Wholesale Producers of and dealers in

CEDAR POLES AND TIES.

FROM THE STUMP TO THE CONSUMER.

Write for Prices.

Menominee, - - Michigan.

## Ask the DeWitt Brown Cedar Co.

MENOMINEE, MICH., for prices on WHITE CEDAR POLES.

1821. 1888.

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INCORPORATED.

Offices 222-224 South Third Street, PHILADELPHIA, PA.

PASCAL IRON WORKS, Philadelphia.
DELAWARE IRON WORKS, New Castle, Del.

Manufacturers of

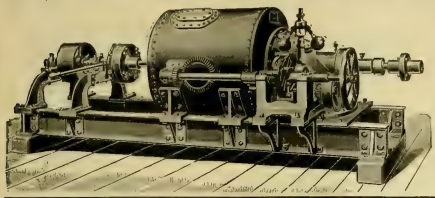
Boiler Tubes, Wrought Iron Pipes and Fittings.

Electric Light and Railway Pipe Poles a Specialty.

## Central Manufacturing Co.,

CHATTANOOGA, MANUFACTURERS AND DEALERS IN TENN.

# Victor Turbine Water Wheel.



**Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.**

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL**, as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double** the **power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

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The accompanying engraving represents a single 10 inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

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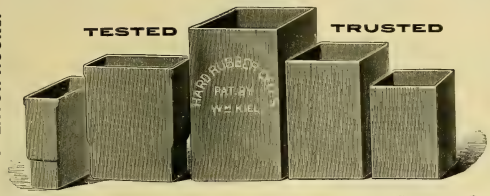


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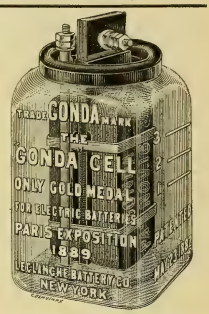


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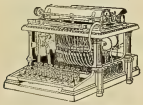

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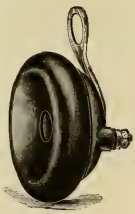

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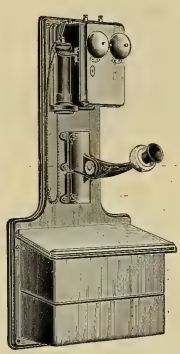

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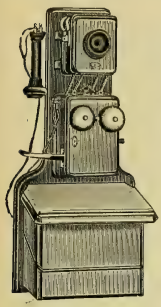

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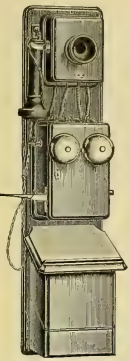

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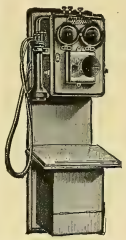

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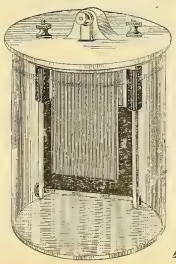

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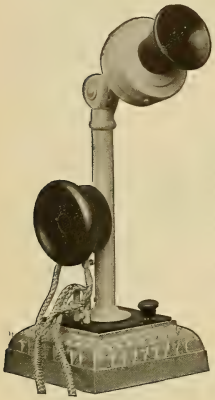

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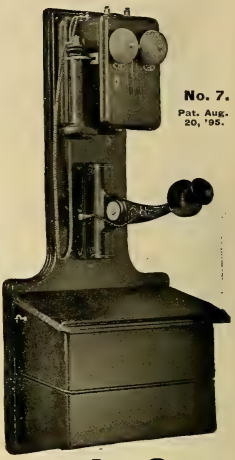

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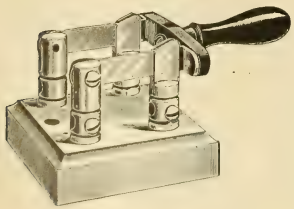

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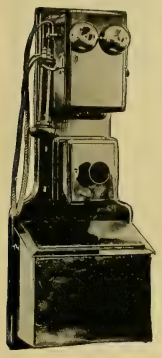

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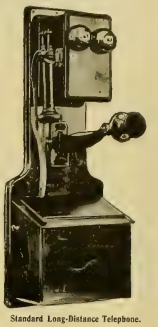

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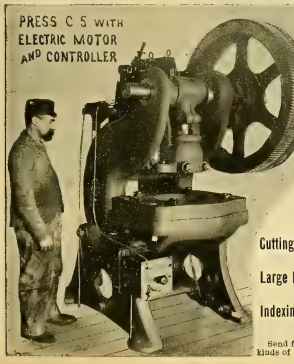


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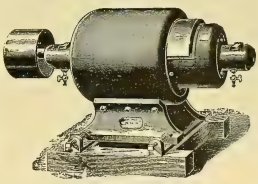

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**Fact No. 12. EXTRA IMPORTANT.**—If you have but **ONE ADVERTISEMENT** to place, you should place **it** in this **GREAT WEEKLY,** the paper which can give you the **BEST, BIGGEST** and **MOST COMPREHENSIVE CIRCULATION** throughout the length and breadth of the land.

SUCH IS THE.....

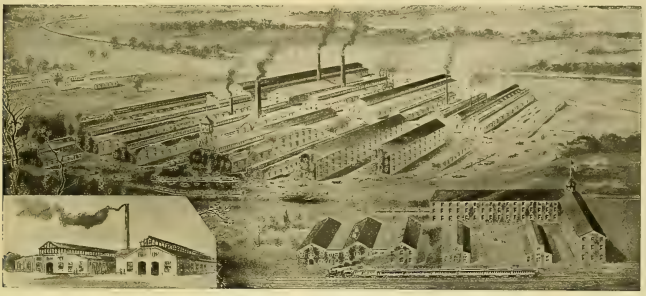
WESTERN ELECTRICIAN.

NEVER OVERLOOK IT.

# GENERAL ELECTRIC CO.,

PRESENT WORKS AT LYNN, MASS.

ORIGINAL THOMSON-HOUSTON WORKS AT NEW BRITAIN, CONN., 1883.



FIRST WORKS AT SCHENECTADY, 1886.

PRESENT WORKS AT SCHENECTADY, N. Y.

## The Largest Electrical Manufacturing Company in the World.

PRESENT LAMP WORKS AT HARRISON, N. J.

FIRST LAMP FACTORY, 1881.

**MAIN OFFICE, SCHENECTADY, N. Y.**

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BUFFALO, N. Y., Morgan Bldg.
BALTIMORE, MD., 227 East German St.
PHILADELPHIA, PA., 509 Arch St.
PITTSBURG, PA., Times Bldg.
ATLANTA, GA., Equitable Bldg.
CINCINNATI, OHIO, 420 West Fourth St.
COLUMBUS, OHIO, 14 North High St.
NASHVILLE, TENN., 308 North Summer St.
CHICAGO, ILL., Monadnock Bldg.
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KANSAS CITY, MO., New York Life Bldg.
ST. LOUIS, MO., Wainwright Bldg.
DALLAS, TEXAS, Cor. Elm and Griffin Sts.
HELENA, MONT., Electric Building.
DENVER, COLO., 505 16th St.
SAN FRANCISCO, CAL., 15 First St.
PORTLAND, ORE., Worcester Bldg.

For all business outside the United States and Canada: Foreign Department, Schenectady, N. Y., and 44 Broad St., New York.

For Canada, address Canadian General Electric Co., Ltd., Toronto, Canada.

# Sawyer-Man Electric Company.

The Board of Directors of the Sawyer-Man Electric Company have much pleasure in announcing that the Company has been reorganized and that the manufacture of the Sawyer-Man incandescent lamp has been resumed. This, no doubt, will be welcome news to every user of incandescent lamps in this country, for the reason that for economy, long life and efficiency, the Sawyer-Man incandescent lamp never had a superior on the market.

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BOSTON, Exchange Building.
CHICAGO, New York Life Building.
TACOMA, WASH., 102 S. 10th Street.
PITTSBURG, Westinghouse Building.
BUFFALO, Erie County Bank Building.
PHILADELPHIA, Girard Building.
ST. LOUIS, American Central Building.
CHARLOTTE, N. C., 36-38 College Street.
SYRACUSE, N. Y., Bastable Building.
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WASHINGTON, D. C., 1333 F Street, N.

May 4, 1896.

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Sole Manufacturers of Paper Insulated Lead Covered Underground Cables for all classes of service. (Thousands of miles in use.)

## THE NATIONAL CONDUIT MANUFACTURING COMPANY,

Sole manufacturers of Cement Lined Conduits. (Twenty million feet in use.)

HIGH POTENTIAL CABLES A SPECIALTY.

These two companies are now combined under one management, with the result that they are enabled to undertake the building of complete underground systems, including the furnishing of the conduits and the cables, and the doing of all the work. **All work guaranteed.**

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# Illinois Engraving Co.

Half-Tone Zinc and Wood Engravers.

WRITE FOR ESTIMATES.

350 DEARBORN STREET, CHICAGO ILL. U.S.A.

# STANDARD LAMP.

HAND MADE - HIGH GRADE

WE MAKE 45 TO 60 VOLTS 8 TO 20 C.P. FOR CENTRAL STATIONS AND NOTHING ELSE.

ONE PRICE, QUALITY, THOUSAND HOURS GUARANTEED

17 CENTS IN ANY QUANTITY.

3 CENTS ALLOWED FOR BURNED OUT LAMPS.

50 WATTS PER 16 C.P.

THEY WILL NET YOU 14 CENTS

THE STANDARD INCANDESCENT LAMP CO. CLINTON, WIS.

# RAU MANUFACTURING COMPANY,

**Russell Bldg., Cor. Randolph and Canal Sts., CHICAGO.**

**MANUFACTURERS OF**

Bell Cluster.

## ELECTRICAL SPECIALTIES,

**DIE AND TOOL MAKERS.**

Screw Machine Work, Stamping,
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**ESTIMATES FURNISHED ON SPECIAL WORK.**

**Send for Catalogue of Clusters, Flanges, Etc.**

Ball Cluster.

Wall Flange.

## PLATINUM IN SHEET OR WIRE FOR ALL PURPOSES

**SCRAP PURCHASED.**

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**A NUMBER OF NOVEL FEATURES.**

Write for illustrated description.

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*Contractors for complete light and power plants.*

*Wire, Lamps, Bells, Batteries, Mica, etc.*

*Northwestern Agents for Siemens & Halske Dynamos.*

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## NEW ORIENT LAMPS

**Are those which bear**

**E**very inspection
Just and fair;

**W**ith others competing
Everywhere.

**O**nly the Best
Is used to prepare

**R**eally Good Lamps
Of quality rare,

**I**n every respect
Made honest and fair.

**E**fficiency Highest
All declare;

**N**o other Lamps
With them will compare.

**T**ry them yourself,
All good things share;

**S**end us your Orders,
We'll use you **SQUARE.**

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CHICAGO OFFICE: 1628 Monadnock, THAD. S. LANE, Mgr.

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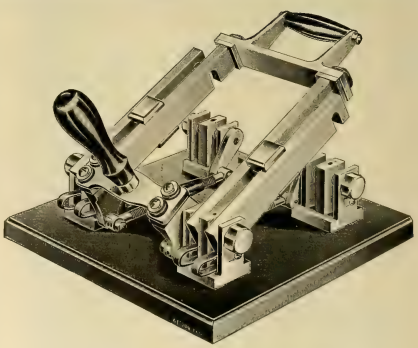
**93 FEDERAL ST., BOSTON, MASS.**

MORRIS METCALF, Representative, 100 Washington St., Chicago, Ill.



"Bolted Contact" Switches
for Heavy Currents...

Highest Grade Fuse Wire and Fuse Links...

...SEND FOR 1896 CATALOGUE...

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of
WOOD LIGHT & POWER SYSTEMS
ELECTRICAL
MACHINERY AND APPARATUS
FOR ARC LIGHTING.
MANUFACTURED BY THE
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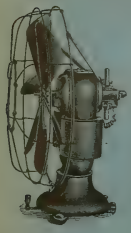
Export Department, 115 Broadway, N.Y. City.

**ROTH BROS. & CO.,**
30-34 Market Street,
CHICAGO,
Manufacturers of



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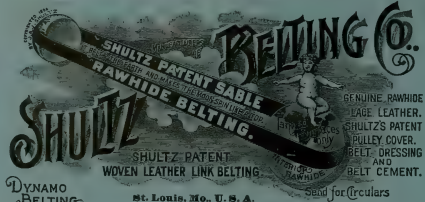
Preservative, Adhesive.
J. E. RHOADS & SONS.
237 Orange St., Wilmington, Del.
BRANCH: Philadelphia, Pa.




BRANCHES: 164 Summer St., Boston; 115 Liberty St., New York; 129 North 3d St., Philadelphia.

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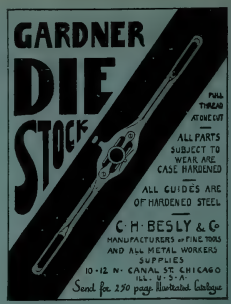


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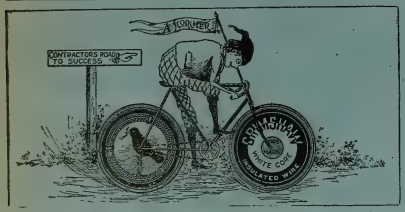


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**COMPETITION LINE WIRE.** Used by some of the largest Central Stations and Fire and Police Departments in the U. S.

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We make any kind of File or Rasp known to the File Trade.

Prompt attention to special work.

Files made to order to suit any purpose.

**Our regular goods are on sale in every leading Hardware Store in the United States and Canada.**

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**KARTAVERT.**

HARD AND FLEXIBLE FIBER IN SHEETS, RODS AND TUBING.

For Electrical and Mechanical Purposes, Railway Dust Guards, Washers and Packings. Patent Insulating Cleats.

MANUFACTURED BY
THE KARTAVERT MANUFACTURING CO., Wilmington, Del.

Protect your Telephone, Telegraph and Fire Alarm Intruments from Lightning and crosses with Electric Light Wires and Trolleys with the improved ½ Ampere Soldered Copper Terminal Mica Fuse. Absolutely perfect. Manufactured only by The American Electric Fuse Co., Room 210 U. S. Express Building, 87 and 89 Washington St., Chicago.

Electric Lighting and Power Apparatus.

Three circuits run from an 80 light 4,000 volt Brush dynamo; the maximum potential between any two points on the circuits, or dynamo, not exceeding 1,250 volts. This will be exhibited at the Brush exhibit at the National Exhibition in New York.

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# Western Electrician.

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Vol. XVIII. CHICAGO, MAY 23, 1896. No. 21



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Weston Standard Illuminated

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Portable Direct Reading Voltmeters and Millivoltmeters. Ammeters and Milliammeters, Wattmeters and Voltmeters, for Alternating and Direct Current Circuits.

Our portable instruments are recognized as standards throughout the civilized world.

Our Semi-Portable Laboratory Standard Voltmeters and Ammeters are still better.

They are the most reliable, absolute standards for Laboratory use.

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MANUFACTURERS OF

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Our machines will operate SUSPENDED from CEILING OVERHEAD or BOLTED DIRECT to SIDE WALL as readily as when occupying floor space in the ordinary manner. All bearings self oiling. See our new patented device for CONNECTING MOTORS DIRECT TO LINE SHAFT, SAVING BELTS, PULLEYS AND FLOOR SPACE.

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Manufactured solely by ALBERT & J. M. ANDERSON, 289 to 293 A Street, Boston, Mass.

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NATIONAL INDIA RUBBER CO.'S Wires and Cables. Factory and Offices: BRISTOL, - R. I.

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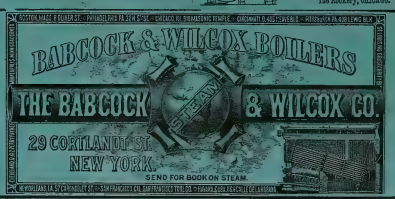
## "CAHALL"

VERTICAL WATER TUBE BOILER. BEST IN THE WORLD.

MANUFACTURED BY The Aultman & Taylor Machinery Co. SEND FOR CATALOGUE. H. E. Collins & Co., Sole Agents for the United States. Bank of Commerce Building, PITTSBURG. The Rookery, CHICAGO.

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High Pressure Boilers. Complete Power Plants. Estimates and Drawings Submitted.

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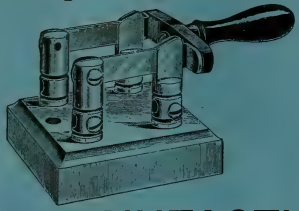
Builders of Improved Automatic Cut-Off Engines.

# The Largest Baby for the Smallest Price.

**IT IS A BEAUTY.**

Switchboards
Switches
Distributing Boards
Fuse Blocks
Spark Coils
Snap Switches



Capacity 35 amperes
Rated at 25 amperes
Metal parts highly polished and lacquered.
Hard Vitrified Porcelain Base

These Switches can be wired back or front, are made with tools especially constructed for their manufacture. They are of the best workmanship and finish.

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AGENTS WANTED IN LEADING CITIES.

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MANUFACTURERS OF

# Automatic Cut-Outs,

TELEGRAPH SELECTORS,

Police and Fire-Alarm Signals.

Experimental and Repair Work of all kinds by best workmen and with most approved tools . . . .

**Give Us a Call.**

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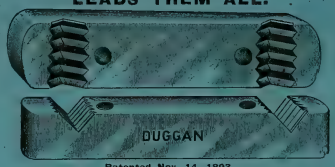
## THE DUGGAN CLEAT LEADS THEM ALL.




Patented Nov. 14, 1893.

FOR SALE BY THE TRADE.

When ordering see that you get the

**DUGGAN.**

Made one wire, two wire, and three wire. . .

They are V shape.

They grip like a vise.

No sagging wire when once stretched.

They are made of finest glazed porcelain. 10 of them used to 1 of any other make.

**SIZES.**

No. 1 holds wire 16 to 8.
No. 2 holds wire 6 to 00.

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.....Porcelain Specialties of all kinds.....

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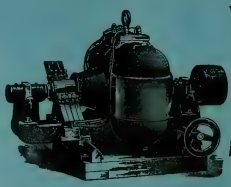
# Electric Motors and Generators,

MANUFACTURED BY

THOS. H. DALLETT & CO.,

York St. and Sedgley Ave., PHILADELPHIA, PA.



Portable Electric Drills, Starting Boxes and Controllers,

Automatic Switches. . . . . Flexible Insulated Couplings.

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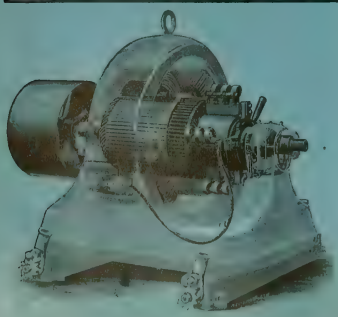

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Manufacturers of

Medium and Slow Speed Electrical Machinery,
Direct Connected Generators,
Direct Connected Elevator Motors,
Direct Grip Hoists,
Motors for Special Work.

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Agents in all large cities.

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# LA CLEDE BATTERIES

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PERU, IND.

PORCELAIN INSULATION Of all Kinds.
We Solicit the making of
SPECAL DESIGNS OF PORCELAIN.

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Cheapest and Best Covering on the Market.
PREVENTS SLIPPING OF BELTS.
Fully Guaranteed. Send for our Catalogue.

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PEER OF ALL
## Commercial Instruments.

Suitable for Isolated Plants and Feeder Circuits in Power Plants. Unsurpassed in appearance and workmanship.

Get New Circular and New Price List. Then you will order.

Agents Wanted in Leading Cities.
The handsomest tested instrument, and for less money, than you can purchase in this country.

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## New Bedford, Mass.,

MANUFACTURERS OF HIGH GRADE

# Switches and Switch Boards.

GENERAL OFFICE and WORKS: New Bedford, Mass.

Plans and Estimates Furnished on application.
Write for Catalogue. . . . . .

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NEW YORK: Machado & Roller, 203 Broadway.
CHICAGO: Central Electric Co., 173-175 Adams Street.


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**Cored and Solid for Direct Lighting.**

## ...LARGE IMPORTATION JUST ARRIVED...

General Western Agents:

## Chicago Edison Company,

**..DEALERS IN ELECTRIC LIGHTING SUPPLIES..**

**Edison Building, 139 Adams Street, CHICAGO, ILL.**

## WESTERN ELECTRIC FAN MOTOR.

THE BEST ON THE MARKET.

Iron-Clad Armature, Self-Oiling Bearings, Carbon Brushes, Perfectly Noiseless and Sparkless. Three Speeds, and Fans in any Finish. Slow Speed, with all the Advantages of High Speed.

....WRITE FOR PRICES....

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## Western Electric Co.,

....CHICAGO....

**ELECTRIC LAMP SIGNS....**

## NEW ERA IN ELECTRIC ADVERTISING.

Each lamp is a single letter, which greatly simplifies the construction of a sign, and permits an unlimited advertising display. This sign is low-priced, economical of operation, easily read, very conspicuous, and may be changed in a moment from one form of words to another. We manufacture High Grade Incandescent Lamps. Lamps of any voltage furnished.

**Ask your NEAREST SUPPLY HOUSE for Sample or write**

## DICKINSON ELECTRIC SUPPLY CO.,

**High Grade Incandescent Lamps,**

American Tract Society Building, NO. 150 NASSAU STREET, NEW YORK.

## "J.P." STYLES of TROLLEY HANGERS.

Strong and Light,
Highest Grade Workmanship and Material.

**Moulded Mica Insulation.** **Vulcabeston** Controller Parts, etc.

*SEND FOR REVISED PRICE LIST.*

No. 900

**H. W. JOHNS MFG. CO.,**

**240-242 Randolph Street, CHICAGO.**

NEW YORK. PHILADELPHIA. BOSTON.

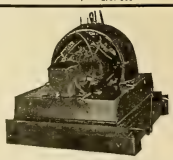
No. 905.

## CARD

Generators for Power Transmission or Isolated Lighting.

CARD Generators are all Multipolar and Slow Speed.

AGENTS WANTED IN UNOCCUPIED TERRITORY.



75 K. W. GENERATOR.

## CARD

Multipolar Slow Speed Stationary Motors.

Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

**THE CARD ELECTRIC COMPANY,**

Office and Works, Mansfield, Ohio.

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## INCANDESCENT LAMPS

QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

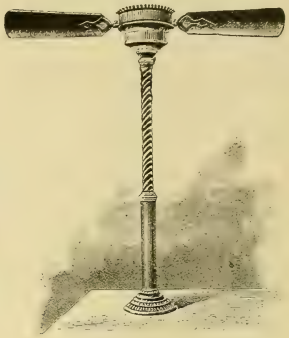
Monadnock Building, Chicago. **THE BUCKEYE ELECTRIC CO., Cleveland, O.**

THE SEASON 1896.

# NEW DIEHL ELECTRIC FANS.

MANUFACTURERS OF

## The Original Direct-Connected Ceiling Fans.



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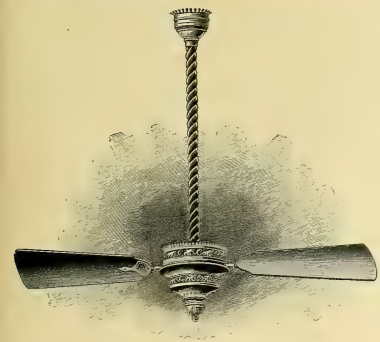
COLUMN, COUNTER COLUMN } FANS.

Exhaust Wheels.

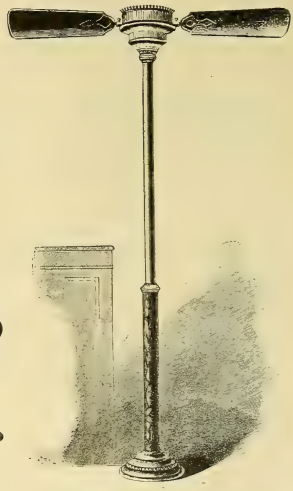


OWNERS OF

Fundamental Patents

COVERING SUSPENDED ELECTRIC

# Fans



FOR CATALOGUE AND PRICE LIST, ADDRESS

# DIEHL MANUFACTURING COMPANY,

ELIZABETHPORT, N. J.

SHOW ROOMS: 561 Broadway, New York. 128 Essex Street, Boston.

See our Exhibit at the National Electrical Exposition, Booths Nos. 118 and 119.

"Upon my life it will do wondrous well."—*Shakespeare.*

# MEDBERY OVERHEAD RAILWAY MATERIAL.

We claim a great deal for the "Medbery," but the single fact that all we claim is carried out to the letter is what makes it the "standard" for superior and economical equipment.

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C. B. ROBERTSON, President. H. S. MEIGS, Secy. and Treas

# LAFAYETTE ENGINEERING & ELECTRIC WORKS,

MAKERS OF

## Dynamos and Power Generators,

Direct Connected or Belted, for Isolated or Central Station Plants.

## Motors for Power Transmission,

Slow, Medium and High Speeds.

THE USE OF MOTORS IN MILLS AND FACTORIES WILL INTEREST YOU.

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St. Paul—Rudolph Wagner.
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Office and Works: Lafayette, Ind.

SEE OUR NEW CATALOGUE.


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Buckeye Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
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Orient Electric Co.
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Sawyer-Man Elec. Co.
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United Elec. Imp. Co.
Westinghouse El. & Mfg. Co.
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Garton-Daniels Electric Co.
General Electric Co.
Utica El. Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.
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Ferracute Machine Co.
Lewis Tool Co.
Murray Iron Works Co.
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Sills & Co., W. H.
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Independent Electric Co.
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New York Insulated Wire Co.
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Besly & Co., Chas. H.
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Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Standard Underground C. Co.
**X Ray Outfits.**
LeRoy, J. A.


For Alphabetical Index of Advertisements See Page III.

# THIS ALTERNATING CEILING FAN WORKS.

**We Guarantee It.**

**No Commutator.**

**No Brushes.**

Uses Less Current than any Fan on the Market.

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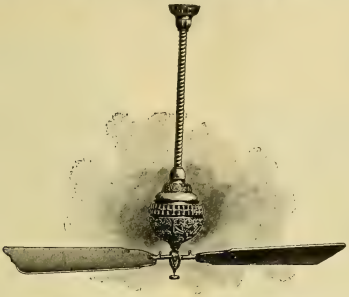
OUR DIRECT CURRENT FAN WORKS.



Our Guarantee is Good.

Only Fan having Blade Adjuster.
Air can be thrown UP or DOWN.
All Bearings SELF-OILING.

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Ask for New Catalogue and Discounts, and you will send us an order.

The Handsomest Fan ever offered to the trade.

Fans Finished in Bronze, Nickel and Polished Brass.
We manufacture a full line of Belt Fans and Water Motors.

AGENTS WANTED IN LEADING CITIES.

## Hunter Fan & Motor Co.,

(Successors to Tuerk Water Meter Co.,)

FULTON, N. Y.

E. B. Latham & Co, Agents, 136 Liberty Street, New York.

# Sprague Electric Elevator Company,

**Postal Telegraph Building, New York City,**

**BUILDERS OF**

## Electric Passenger and Freight Elevators.

**The Multiple Sheave Screw Machine** Duplicates Hydraulic Service with less than half the water evaporation and coal expenditure.

It has any required speed and capacity. Each machine is an independent unit. Like parts are interchangeable. It has a superior down start. It occupies less space. It is absolutely safe.

**The Worm Gear Drum Machine** is for all classes of intermediate service. It is the most perfect machine of its type built.

**The Automatic House Elevator** is absolutely safe. It requires no operator.

Among typical buildings adopting Sprague Machines are:

Postal Telegraph Building, New York City; Parrott Building, San Francisco; Board of Trade, Chicago; Guaranty Building, Buffalo; Syndicate Building, New York City; Union Trust Building, Detroit; Gerken Building, New York City; Custom House, New York City; Merchants' National Bank, Baltimore; Hotel Walton, Philadelphia; J. T. Williams Office Buildings, New York City; Mabley Building, Detroit; Young Men's Christian Association, New York; Daniells' Stores, New York; Court House and City Hall, Minneapolis; Boston Daily Globe, Boston; Safe Deposit Building, San Francisco; Academy of Music, San Francisco; Canada Life Insurance Co., Montreal; State Mutual Life Assurance Co., Worcester; Johns Hopkins University, Baltimore; Edison Electric Illuminating Co., New York; Currier Bank Building, Los Angeles; Ahrens Building, New York; Wadsworth Building, New York; The Callender, McAuslan & Troup Company's Department Stores, Providence; the residences of Mr. John Jacob Astor and Mr. George Morgan, New York; City and County Court House, Salt Lake City; Graham Building, New York City; Mutual Benefit Insurance Co., Boston; Government Printing Office, War Department, Washington; Wilcox Building, Los Angeles.

Recent contracts include four of the finest and most costly buildings of their respective classes ever projected:

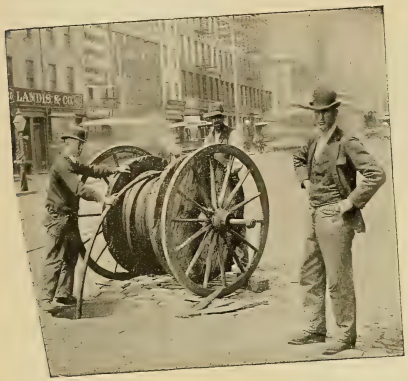
Manhattan Hotel, 9 Elevators. Siegel-Cooper Stores, 21 Elevators.
Commercial Cable Building, 21 Stories.
Mr. John Jacob Astor's New Palatial Hotel, 19 Elevators.

# THE NATIONAL UNDERGROUND CABLE COMPANY,

Sole Manufacturers of Paper Insulated Lead Covered Underground Cables for all classes of service. (Thousands of miles in use.)

## THE NATIONAL CONDUIT MANUFACTURING COMPANY,

Sole manufacturers of Cement Lined Conduits. (Twenty million feet in use.)



HIGH POTENTIAL CABLES A SPECIALTY.

These two companies are now combined under one management, with the result that they are enabled to undertake the building of complete underground systems, including the furnishing of the conduits and the cables, and the doing of all the work. **All work guaranteed.**

**NEW YORK. PHILADELPHIA. CHICAGO. BOSTON.**

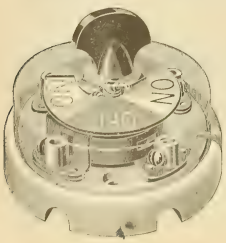
We are making the very best Carbons now on the market, and selling them at prices that you cannot afford to remain unaware of. Operating as we do the largest factory outside of the "Trust," with a daily capacity of 150,000 carbons, the prompt execution of large orders is assured.

## THE AMERICAN CARBON CO.,

**Noblesville, Ind., U. S. A.**

NEW YORK: 219 Havemeyer Bldg. BOSTON: 182 Summer Street. CHICAGO: 1537 Monadnock Bldg.

## THE PERKINS DIAL SWITCH.




For current of from 5 to 50 amperes, and as high as 500 volts.

Shows when current is "ON" or "OFF." Handles a street railway current for lights ....or car heaters....

Our Crookes' Tubes Take Pictures.

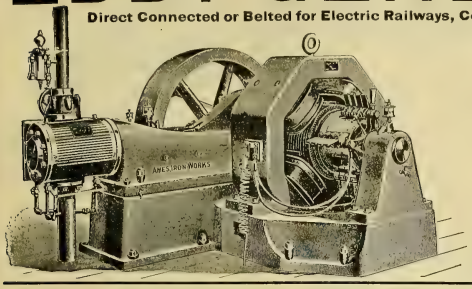
SEND FOR NEW CATALOGUE.

## PERKINS ELECTRIC SWITCH MFG. CO.,

HARTFORD, CONN.

# EDDY GENERATORS.

**Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.**



**Eddy Motors—Slow, Medium or High Speed.**

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

## The Eddy Electric Mfg. Co.,

**WINDSOR, CONN.**

NEW YORK, H. B. Coho & Co., Mail and Express Building.
PHILADELPHIA, Walter C. McIntire & Co., 506 Commerce St.
BOSTON, G. M. Angier & Co., 64 Federal St.
ELMIRA, S. N. Blake.
ST. LOUIS, Western Electrical Supply Co.
KANSAS CITY, W. T. Osborn.
CINCINNATI, O., Nevada Bldg., John A. Stewart.
CHICAGO, 305 Dearborn St., Wallace & Hine, Managers.

# IMITATION IS THE HIGHEST PRAISE.

When we first offered enclosed arc lamps, doubters SMILED incredulously; NOW they are COPYING the "PIONEER," and while we appreciate this endorsement and the delicate compliment of imitation, we hereby give notice that we intend to

## STOP ALL INFRINGERS ON OUR PATENTS

And are pushing our suit in the U. S. Circuit Court against prominent users of other enclosed arc lamps. We trust this will be taken as fair warning to avoid litigation.

## The Electric Arc Light Co.,

**687 and 689 Broadway, New York.**

LOUIS B. MARKS, M.M.E.,
CHIEF ELECTRICIAN.

The "Pioneer" Enclosed Arc Lamp burns 100 to 150 hours; saves $15 to $20 annually per lamp in carbon and trimming; is shadowless, noiseless, steady, simple and safe.

# Sawyer-Man Electric Company.

The Board of Directors of the Sawyer-Man Electric Company have much pleasure in announcing that the company has been reorganized and that the manufacture of the Sawyer-Man incandescent lamp has been resumed. This, no doubt, will be welcome news to every user of incandescent lamps in this country, for the reason that for economy, long life and efficiency, the Sawyer-Man incandescent lamp never had a superior on the market.

**WRITE FOR PRICE LIST TO THE FOLLOWING OFFICES OF THE COMPANY:**

NEW YORK, 120 Broadway.
BOSTON, Exchange Building.
CHICAGO, New York Life Building.
TACOMA, WASH., 102 S. 10th Street.
PITTSBURG, Westinghouse Building.
May 4, 1896. BUFFALO, Erie County Bank Building.
PHILADELPHIA, Girard Building.
ST. LOUIS, American Central Building.
CHARLOTTE, N. C., 36-38 College Street.
SYRACUSE, N. Y., Bastable Building.
SAN FRANCISCO, Mills Building.
WASHINGTON, D. C., 1333 F Street, N.

# SEVEN THOUSAND

Manhattan Arcs in service. One hundred Edison Central Stations. One pair of half-inch carbons will burn one hundred and fifty hours; will burn singly on incandescent circuits, avoiding the necessity of burning two lamps in series. A perfect diffusion of light is obtained by the use of double enclosed globes. Lamp is fire-proof and absolutely noiseless. Lamps to burn in series on circuits from two hundred to five hundred and fifty volts. Length twenty-four and thirty-seven inches.

# MANHATTAN

## Enclosed Arc Lamps.

Put in a new carbon and trim it once every one hundred and fifty hours. Figure what that will save you.

• • •

**We have on hand five hundred Incandescent Arc Lamps of all makes, which we have displaced by "Manhattans," which we offer complete at $3.00 each.**

• • •

## Manhattan General Construction Co.

NEW YORK: 44 Broad St. CHICAGO: Monadnock Block. BOSTON: 140 Congress St.

# The Warren Alternator.

**Induction Type** | Without Moving Wires. Without Collector Rings. Without Brushes.

**Any Voltage** 110 / 220 / 440 Volts without 1,000 / 2,000 / 6,000 Volts with **Transformers.**

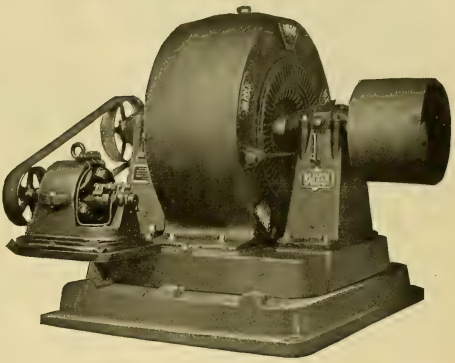
Stationary Single Ring Armature—Stationary Field Coil.

Revolvable Part a Solid Cylinder of Steel.

**EFFICIENCY THE HIGHEST** } Of any Alternating Current Generator known.
**REGULATION THE CLOSEST** }

NOISELESS IN OPERATION.

BUILT TO EARN MONEY WITH—NOT TO SPEND MONEY UPON.



## Warren Electric Co., Chicago.

**SALES AGENTS:**

| Wendell & McDuffie. | Bates Machine Co., | A. M. Searles, | California Electrical Works, |
|---|---|---|---|
| 126 Cortlandt St., New York. | 154 Congress St., Boston, Mass. | 281 Dearborn St., Chicago. | San Francisco, Cal. |

# REPAIRING.

## ARMATURES AND COMMUTATORS.

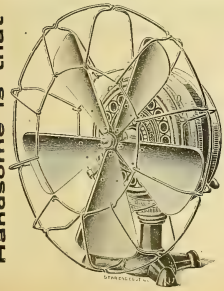
ARC LAMP SUPPLIES made to order.

Supplies for the "American Wood" System. Dynamos and Lamps.
Carbon Holders for all makes of Arc Lamps.

## CHAS. J. BOGUE, - 204 Centre St., New York.

THE **EMERSON ELECTRIC MFG. CO.,**
ST. LOUIS, MO.,
And 112 Liberty St., New York.

"Handsome is that Handsome does."

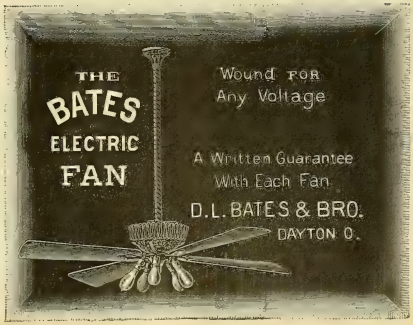


TYPE E. I. 1.

**NOTE THIS**
**Current Consumption:**

"Meston" 12-inch fan, 60 to 70 watts.
" 16-inch fan. 70 watts.
Induction 12-inch fan, 7,200 alts., 80 to 90 watts.
Induction 16-inch fan, 7,200 alts., 110 to 125 watts.
Induction 12-inch fan, 16,000 alts. ,90 to 100 watts.

**CHEAPEST**
Fan Motors on the market because
**BEST.**



# A Good Thing 4-U-2-C.

**OUR EXHIBIT IN SEC. C, SPACE 161, AT THE NATIONAL ELECTRICAL EXPOSITION, NEW YORK.**

# PARTRICK & CARTER CO., PHILADELPHIA,

**Manufacturers of Electrical House Goods.**

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*JUST NOW*

Is the time to decide on the Fan Motor you intend to handle this season. Our direct current motor is equal to the best, if its intrinsic merit is considered.

**Annunciators, Medical Farradic Batteries.**

MAGNETO, HAND AND POWER

**...GENERATORS...**

**INDUCTION AND SPARK COILS, ETC., ETC.**

WRITE FOR CATALOGUE

**Menominee Electrical and Mechanical Co.,**

**MENOMINEE, MICH.**

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**"Eyanson" Quick Break Switch.** PATENTED JULY 16, '95.

**EYANSON & ARMPRIESTER,**

Formerly J. Grant High & Co.,

123 N. 3rd STREET, PHILADELPHIA, - PA.

Switches and Switchboards of all Descriptions.

Write for our new catalogue "D."

**BRANCH OFFICES:**

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NEW YORK: 136 Liberty St., Chapin & Douglas.
LOUISVILLE, KY.: 313 W. Main St., James Clark, Jr. & Co.
NEW ORLEANS, LA.: 608 Custom House Street, Widmer & Spranley.

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CHICAGO OFFICE, 107 E. MADISON STREET.

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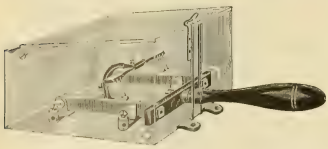
# Arc Knife Switch.



NO SPRINGS TO BREAK.

ALWAYS RELIABLE.

**ORDER ONE, YOU WILL ORDER MORE.** **GENERAL REPAIRING.**

Incandescent and Power Knife Switches, Lightning Arresters.

**Write Us.** **Get Our Discounts.**

**SINGLE AND DOUBLE POLE IRON-BOX FUSE BOXES.**

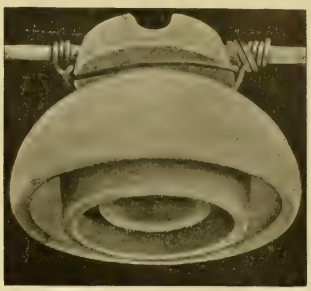
**Utica Electrical Mfg. & Supply Co., - Utica, N. Y.**

# OVERHEAD LINES

**Made Safe**

BY USING MY....

## Indestructible High Insulation Material.



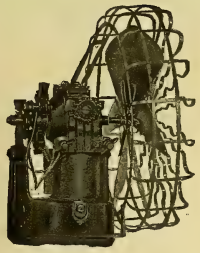
**Triple Petticoat China Insulator.**

## My Steel Insulating Pins Will Not Break.

MY CHINA INSULATORS will carry any current at any Potential with Safety and Economy. . . .

**Send for Catalogue.**

## FRED M. LOCKE, = Victor, N. Y.



*LOTS OF OTHER FAN OUTFITS*

# BUT ! ! !

The C-W FAN OUTFITS have 6 BLADE, 12 and 16-INCH FANS instead of the usual 10 and 15-inch 4 Blade.

They will therefore do **BIG WORK** if you want it.

The Fan guard is ornamental and substantial and close enough mesh to prevent a Fan blade from flying out should it, by chance, be broken while in operation.

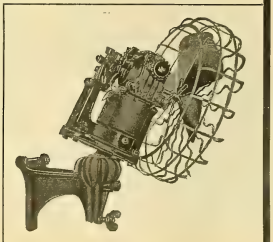
The complete Fan Outfit may not address itself to your eye as pleasantly, as to design and shape, as some others, it having been considered unwise to sacrifice stability to enhance its appearance.

If you want a Fan Outfit for this season and will want it again next season, and several following seasons, you want the **C-W.** Let our Selling Agents talk to or write you.

## *Crocker-Wheeler Elec. Co.,*

MANUFACTURERS AND ELECTRICAL ENGINEERS,

**39 and 41 Cortlandt St., New York.**



WE tell you here only about FANS. This is the FAN SEASON. We also manufacture "The Best" in Dynamos and Motors of Standard and Special Types in all practical sizes. If interested in these please write us. . . . . .

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F. S. Blackall & Co., 126 Liberty St., New York.
N. E. Electric Supply Co., 49 Federal St., Boston.
New Orleans Electric Co., 728 Gravier St., New Orleans.
Abner Doble Co., 13 and 15 Fremont St., San Francisco.
Harry S. Smith, 607 Chestnut St., Philadelphia.

# PACKARD LAMPS

Maintain their Enviable Reputation for

EFFICIENCY,
LIFE,
NON-DISCOLORATION,
LIGHT.

THE BEST LAMP ON THE MARKET, AND AT A FAIR PRICE.

General Western Agents:

**ELECTRIC APPLIANCE COMPANY,**

Electrical Supplies, 242 Madison Street, Chicago.

# WHY BE A FOGY?

GASKETS MADE INSTANTLY WITH

⅜ in. for **UNIONS.**

½ in. for **HAND-HOLES.**

⅝ in. for **MAN-HOLES.**

Put up in boxes, weight 3 to 6 lbs.

Patented and Manufactured exclusively by

**PEERLESS RUBBER MANUFACTURING CO.,**
16 Warren St., NEW YORK.

# PERFECT INSULATION

Can only be Secured by the use of . . . **P** and **B** Compound, Varnish, Tape, Paper.

Are You Acquainted With Them?

IF NOT, WRITE FOR PARTICULARS TO

The STANDARD PAINT COMPANY, Sole Manufacturers, 79-81 John St., New York.

METROPOLITAN ELECTRIC CO., 186-188 Fifth Ave., . . . CHICAGO.

I-T-E AUTOMATIC MAGNETIC CIRCUIT BREAKERS

# C-S FLUSH SWITCHES

CUTTER ELECTRICAL AND MFG. CO.
1112 SANSOM STREET, PHILADELPHIA

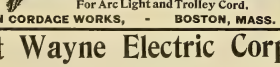
All Kinds OF **MICA.**

# CHICAGO INSULATED WIRE CO.,

153 LAKE STREET, - CHICAGO.

SEND FOR SAMPLES AND PRICES OF

SAMSON SPOT CORD



For Arc Light and Trolley Cord.

SAMSON CORDAGE WORKS, - BOSTON, MASS.

# Fort Wayne Electric Corporation,

FORT WAYNE, IND.

Apparatus for

**Arc, Direct Current and Alternating Incandescent Lighting and Power Transmission.**

# AJAX ARC LAMPS.

Perfect in regulation and cheap to buy.

C. S. VAN NUIS, - - - - 136 LIBERTY ST., NEW YORK.

**BI-METALLIC WIRE.**
COPPER AND STEEL.
(JOHN A. ROEBLINGS' SONS CO., Makers.)
Bi-Metallic Electric Transmission Co.
1204 Havemeyer Building,
26 Cortlandt St., New York.
Send for descriptive pamphlet.

**A NEW CIRCULAR**
Describing the
HOYT STATION AMMETERS AND VOLTMETERS
Sent free on Application.
WHITNEY ELECTRICAL INSTRUMENT CO.,
PENACOOK, N. H., U. S. A.

**F-G** MEANS
No Wear on Commutator.
No Sparking Under Varying Load.

Holmes Fibre-Graphite Mfg. Co.,
Station Z, Philadelphia.

# Electrical Supplies and Fixtures.

New Catalogue will be Sent on Application.

# SAL AMMONIAC.

(ELECTRIC BRAND.)

FOR ELECTRICAL PURPOSES.

Guaranteed 98/99 per cent. and free of lead and iron. If you want the best quality ask your dealer for this brand. Imported by

A. KLIPSTEIN & COMPANY, 122 Pearl St., New York.

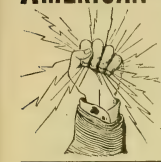
# Chicago General Fixture Co.,

169 Adams St., Chicago.

EUGENE F. PHILLIPS, Prest. W. A. HATHAWAY, Treas. W. H. SAWYER, Secy.

# AMERICAN ELECTRICAL WORKS,

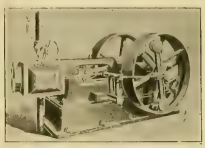
PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
Railway Feeder and Trolley Wire,
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, P. C. Ackerman, 10 Cortlandt St.
CHICAGO STORE, F. E. Donohue, 251 Madison St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

(130)



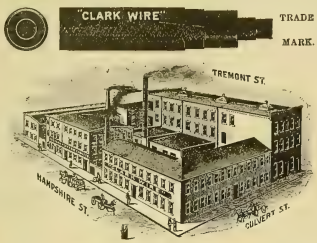
## Pointer No. 9.

Our engine governor is the simplest in existence. Requires NO OIL, and will maintain a stated speed under any change of load.
See the regulation guarantee in catalogue.
CATALOGUES FREE.
"A" ENGINES. "B" DYNAMOS.

J. H. McEwen Mfg. Co.,
Church, between Dey and Cortlandt Sts.,
NEW YORK.

THE

# "CLARK" WIRE.




TRADE MARK.

For Switchboard, Railway and Motor use, we make all sizes of Stranded and Flexible Wire and Cables with Clark's Insulation.

The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

In a Letter from the Inspector of the Boston Fire Underwriters' Union, he states: "A Thoroughly Reliable and Desirable Wire in every respect."

The Rubber used in insulating our Wires and Cables is especially chemically prepared, and will not deteriorate, oxidize or crack, and will remain flexible in extreme cold weather, and is not affected by heat.

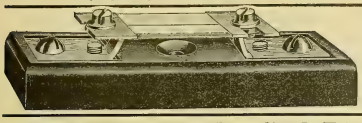
We guarantee our Insulation wherever used, Aerial, Underground or Submarine, and our net prices are as low, if not lower, than any other first-class Insulated Wire.

We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

## Eastern Electric Cable Co.,

61 and 63 Hampshire St., Boston, Mass.

HENRY A. CLARK, Treas. and Genl. Mgr. HERBERT H. EUSTIS, Pres. and Electrician.



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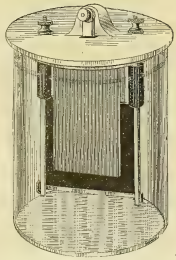
your Telephones and Telegraph Instruments from Lightning, Electric Light and Trolley Wires, by using the 1-2 Ampere Soldered Copper Terminal Mica Fuse. Manufactured only by the AMERICAN ELECTRIC FUSE CO., 87-89 Washington Street, Chicago, Ill.

# NOVELTY ELECTRIC CO.,

50, 52 and 54 N. Fourth St., Philadelphia, Pa.,

## ELECTRIC RAILWAY, LIGHT, POWER AND HOUSE MATERIALS.

**We manufacture one of the best and handsomest Needle Annunciators. Write us for prices.**



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For Fan Motors, Gas Engines, Railroad Crossing Signals, Dental Engines, Phonographs, Cautery.

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For sale by all representative Electric Supply Houses throughout the country. Write for catalogue.

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Orders one thousand two hundred and fifty pounds of "MICANITE" plates, size 18x36, for Commutator Insulation.

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PERFECT MICANITE INSULATOR REGISTERED

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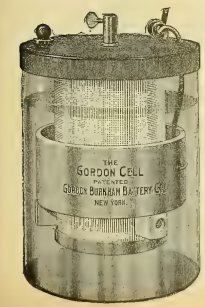


## Gordon Primary Battery

EXCELS IN

Long Life, Efficiency,
Economy, Adaptability,
It is absolutely Non-Freezing.
Labor Saving,
Free from Local Action,
Freedom from Gases and Odors.
Superior Generation of Energy.

These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America.
Send for descriptive circular and price list. We guarantee all our Cells.

MANUFACTURED BY

The Gordon-Burnham Battery Co.,
82 West Broadway, New York.

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

AGENCIES:

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PETTINGELL-ANDREWS CO., BOSTON, MASS.
ELECTRICAL ENGINEERING CO., MINNEAPOLIS, MINN.
ST. LOUIS ELECT'L SUPPLY CO., ST. LOUIS, MO.
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# Phillips Insulated Wire Co.,

NEW YORK OFFICE: 39 and 41 Cortlandt St.

FACTORY: Pawtucket R. I.

## Wanted by a Good Salesman—

Of ability, with clean record, sober and industrious, well versed in electric machinery and supplies, competent to figure and contract for construction work, superintend and install lighting and power plants a position. Good references. Address EXPERT, care WESTERN ELECTRICIAN, Chicago, Ill.

## WANTED.

Position as engineer of some good electric plant. Experienced with Corliss and high speed engines, arc and incandescent dynamos, direct and alternating current, exhaust steam heating, etc. Can give best of references. Address **"B. B."** care WESTERN ELECTRICIAN, Suite 510 Marquette Building, Chicago.

## WANTED.

Position by young man having had large practical experience with electric lighting and power machinery, and understands arc light repairing; also experienced in the care of steam plants. Can give good references.

Address **"J. V. E."**
Care WESTERN ELECTRICIAN.

## WANTED—

A foreman for shop in a Western city; must be first-class mechanic and electrician, conversant with all classes of work. References necessary. State wages expected. Address FOREMAN, care WESTERN ELECTRICIAN.

## LIGHT PLANT FOR SALE.

A controlling interest in an electric light plant, located in the most prosperous city of its size in Central Illinois, is offered for sale at a great bargain. Forty-five arc and 3,000 incandescent lamps in circuit. City contract 3 years to run. Only plant in the city. Business growing rapidly. Coal delivered at the boilers for 35 cents per ton for slack, 90 cents for lump. Capital stock $20,000, no bonds. Twenty per cent. earned last year. Good reason for selling. Address for further information. **"Dynamo,"** WESTERN ELECTRICIAN Office.

### For Sale.

4000 rubber storage battery jars; 28 storage battery car motors; 50 ammeters; 5 focusing arc lamps; 1400 incandescent lamps, 48 to 60 volts; two 100 light incandescent dynamos; five 20 arc light dynamos; five 15 arc light dynamos; one 225 volt 50 ampere dynamo; one 250 volt 100 ampere dynamo. New wire of various sizes. Any of above will be sold low or will exchange for old material. WALSH'S SONS & CO., Newark, N. J.

### Bargains in Machinery for Street Railways.

One 600 h. p. Corliss engine, one 300 h. p. Corliss engine; one 300 h. p. Westinghouse compound engine; one 250 h. p. Ball automatic engine; two 125 h. p. Ball automatic engines; two 80 h. p. Ball automatic engines; two 125 h. p. generators, 500 volts; four 60 h. p. generators, 500 volts; large stock of automatic engines and dynamos of every description. Also a battery of compound boilers, 700 h. p., 160 h. p. in a pair. FRANK TOOMEY, 131 N. Third Street, Philadelphia.

## FOR SALE.

One 1,000 light incandescent dynamo and one 160 light incandescent. Both direct current, compound wound.

**L. A. HINE & CO.,**
234 E. Lake Street,
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## FOR SALE.

A 1,300-light Fort Wayne Alternating Incandescent Dynamo, with Exciter. Second-hand, but in perfect order. Address

**THE S. FREEMAN & SONS MFG. CO.,**
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# FOR SALE.

Here goes the last machine, and to close out the lot and make a quick sale it will be sold for

**FIVE HUNDRED DOLLARS CASH.**

It is a 50 Light 2,000 Candle Power Arc Dynamo, made by the Standard Electric Co., and has the usual accessories. It has never been in use and is guaranteed. Who gets it?

Address **CASH,**
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## FOR SALE.

1,500 tons 60-lb. relaying rails; 1,000 tons 75-lb. relaying rails; 800 tons 45-lb. relaying rails. 30 electric cars in good order. New electric cars and new and second-hand passenger cars. 50 box and 50 flat cars, 25 tons capacity. Specialty in negotiating electric and steam railroad bonds when payable at Farmers' Loan and Trust Co., N. Y., or Knickerbocker Trust Co., 66 Broadway, N. Y., and printed at an A1 Bank Note Company in N. Y.

**ROLLING STOCK SOLD ON EASY TERMS.**

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$1.00 EACH.

**ELECTRICIAN PUB. CO.,**
CHICAGO.

## Proposals Wanted for Steam and Electric Machinery for City Lighting Plant and for the Operation of Same.

CITY OF MADISON, WIS.—Sealed proposals will be received at the office of the City Clerk of the City of Madison, Wis., until noon of June 12, 1896, for furnishing all labor and materials for the engines, dynamos, pole line and circuits for an electric lighting plant, for said city, and for the operation of same, in accordance with the plans and specifications on file with the city clerk. All bids must be addressed to O. S. Norsman, City Clerk, Madison, Wis., and endorsed on the outside of envelope: "Bids for Electric Lighting Plant and operating same." Each bidder must deposit with his bid a certified bank check for an amount equal to five per cent. of the total cost of the plant, payable to the order of John H. Clark, City Treasurer, which sum shall be forfeited to the City of Madison in case the bidder refuses or neglects to enter into a contract (subject to confirmation by the City Council) within five days after he shall have been notified of the acceptance of his proposal. Checks deposited with rejected bids will be returned to owners on demand. The bidder whose tender is accepted will be required to furnish with his contract an approved bond to the City of Madison, Wis., in such sum, not exceeding the cost of plant; as the Common Council shall determine, conditioned on the full and faithful performance of his part of the contract. Another bond for not exceeding $20,000, running to the people of the State of Wisconsin, will be required, conditioned for the payment of wages earned and material furnished in the performance of the contract. On the proper execution of the contract and bonds, the guarantee deposit will be returned to the contractor. Copies of the plans and specifications can be seen at the office of the City Clerk at Madison, Wis., and of the Consulting Engineer, Frank B. Rae, Consulting Engineer, Room 910 Fort Dearborn Bldg., 134 Monroe St., Chicago.

The City Council expressly reserves the right to reject any or all proposals, or to waive any irregularity in any proposal.

A. A. DYE, Mayor.

O. S. NORSMAN, City Clerk.

Dated at Madison this 12th day of May, 1896.

## Stilwell's Patent LIVE STEAM-FEED Water Purifier.

**Removes all Impurities.**

ENTIRELY PREVENTS SCALE IN STEAM BOILERS. Catalogue on Application.

The Stilwell-Bierce & Smith-Vaile Co.,
DAYTON, OHIO.

**Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agent.**

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# FOR SALE.

**One 150 Light Mather Incandescent Machine with Spare Armature.**

**One 100 Light Mather Incandescent Machine.**

## FOR SALE VERY CHEAP.

**Practically new, in A1 condition.**

Address, **"BUYER,"**
Care WESTERN ELECTRICIAN, Suite 510 Marquette Bldg., Chicago, Ill.

**ESTABLISHED 1880.**

**W. C. Sterling, Sr. W. C. Sterling, Jr.**

## Cedar Poles.

Poles for Railway, Telephone, Telegraph or Electric Light Plants, Standard Norway Pine, Painted Cross Arms and Oak Pins.

**Six large sorting pole yards in Michigan.**
Get prices on first grade poles for city construction and buy of an old reliable firm.

**W. C. STERLING & SON, MONROE, MICH.**

## MAYOR'S OFFICE,

SAN ANTONIO, TEXAS, May 9, 1896.

Bids will be received by the City Clerk and opened by the undersigned at 12 m. June 5th, to light the streets of San Antonio with arc electric lights, as per specifications to be had on application to the City Engineer of said city.

The City of San Antonio reserves the right to reject any and all bids.

(Signed) **HENRY ELMENDORF,**
**Mayor.**

ATTEST: E. R. NORTON,
City Clerk.

## STUDENTS

Will find that the WESTERN ELECTRICIAN can help them wonderfully in the study of electricity. Subscribe now.

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WHOLESALE
**Telegraph, Telephone, Electric Light**
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Manufactured from Live Cedar peeled. Quick shipments and best quality.
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**Can furnish any size, shape or pattern. Write for samples and quotations.**

**A. O. SCHOONMAKER,** Importer,
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WHITE CEDAR — Telephone Electric Light, — STREET R. R. AND — STREET CAR TIES.

Write for delivered prices. **LINDSLEY BROS., Menominee, Mich.**

Write PAUL PERRIZO JR. CEDAR & LUMBER COMPANY, Marinette, Wis. for prices on

## WHITE CEDAR POLES

before purchasing elsewhere.

**The Brady Mast Arms.**

T. H. Brady, New Britain, Conn., U. S. A.,

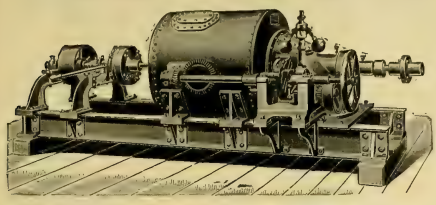
Manufacturer of Mast Arms, Pole and Swinging Hoods, House Brackets and other Specialties for Construction Work.—*Catalogues and Prices furnished on application.*

**A. L. LEWIS & CO.,**
Wholesale Producers of and dealers in
**CEDAR POLES AND TIES.**
FROM THE STUMP TO THE CONSUMER.
Write for Prices.
**Menominee, - Michigan.**

## Ask the DeWitt Brown Cedar Co

**MENOMINEE, MICH., for prices on WHITE CEDAR POLES.**

# Victor Turbine Water Wheel.



**Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.**

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double the power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

*SEND FOR CATALOGUE AND PARTICULARS.*

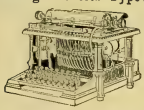
The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts, and where the situation admits of their use we recommend them.

**THE STILWELL-BIERCE & SMITH-VAILE CO., DAYTON, OHIO.**

Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agents.

## The Remington-Sholes Typewriter



Is a recent production of the best inventive skill in the country and is . . . .

**NOT**

behind any typewriter . . . . .

**IN**

the line of such improvements as are essential to the success of . . . .

**ANY**

writing machine. In fact, the REMINGTON-SHOLES . . . . . .

**TYPEWRITER**

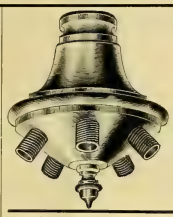
leads all others in that . . . . .

**COMBINATION**

of features which please the operator and make it a pleasure instead of hard work to run our machine.

**Send for catalogue or call and examine.**

**REMINGTON-SHOLES TYPEWRITER CO.,**
**138 MONROE STREET,**
**CHICAGO.**



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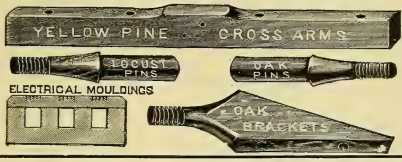
Russell Bldg., Randolph and Canal Sts., Chicago, Ill.,

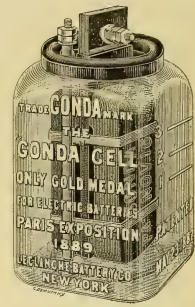
MANUFACTURERS OF

Clusters, Flanges,
Special Electrical Goods.

## Central Manufacturing Co.,

CHATTANOOGA, MANUFACTURERS AND DEALERS IN TENN.

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**WILL PROTECT WHEN ALL OTHERS FAIL.**

Unequaled for Durability, Reliability and Efficiency! Our testimonials back up all of our claims. Send for them.

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SWITCHES. SWITCH BOARDS. TABLET BOARDS

*Manufacturing Electricians,*

LOCAL AND LONG DISTANCE TELEPHONE COMMUNICATION

*123 South Third Street,*

*Philadelphia, Pa.,* May 6 1896

The ''Western Electrician''

Chicago Ill,

Gentlemen:-

We have just received your May 9th, number, and although it is not requested by personal letter to us we can not but help to tender to you our congratulations upon the appearance of this paper

And in this same letter we wish to take an exception to an item in your own advertisment on page 1xii Fact 5''West of the Alleghanies'' should not appear. We are pretty near as far East of them as we can get and we receive the W.E. as soon as any other paper, and this particular number before the most of them in fact all except Electricity.

Don't be too modest.

Again congratulating you we are

Very truly yours

'Dic. by G. T. E.

*Eyanson & Armpriester*


STANDARD LAMP.

HAND MADE - HIGH GRADE

WE MAKE 45 TO 60 VOLTS 8 TO 20 C.P. FOR CENTRAL STATIONS AND NOTHING ELSE.

3 CENTS ALLOWED FOR BURNED OUT LAMPS.

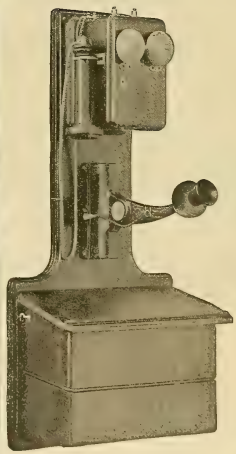
ONE PRICE, QUALITY, THOUSAND HOURS GUARANTEED

17 CENTS IN ANY QUANTITY.

50 WATTS PER 16 C.P.

THEY WILL NET YOU 14 CENTS.

THE STANDARD INCANDESCENT LAMP CO.
CLINTON, WIS.



SOLD ON... THEIR MERITS.

In placing this instrument on the market we take pleasure in stating that after a series of tests made by one of the largest railroad corporations in the United States, and by several of the best informed Telephone Experts in the country, we have been informed that our instruments far surpass any telephone now on the market, for the following reasons:

**Simplicity in Construction;**

**Impossibility of Packing under any Conditions;**

**Sensitiveness and Clearness of Articulation.**

**Least Affected by Induction of any Instrument now on the market.**

**Indestructibility—Will Last a Lifetime with ordinary care, and will be as effective after 5 years' use as the day they were set up.**

**A Test of this instrument will prove every claim we have made for it, and we simply ask a trial to convince the buyer.**

We furnish the Transmitter Arm to those who may wish to replace the transmitters on other makes of instruments.

For Prices and Discounts write to

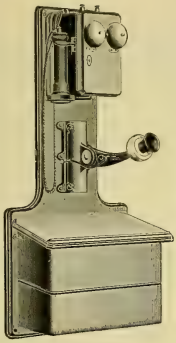
Connecticut Telephone... ...and Electric Co.,

CHICAGO OFFICE, No. 195 La Salle St.

MERIDEN, CONN., U. S. A.

# Our Telephones

Talk for our Patrons, and our Patrons Talk for us.



**Cem Watch Case Receivers,**

**55c. Each.**

Send for our New Catalogue of Telephone Transmitters, Magneto Bells, and all parts of Telephones.

# MIANUS ELECTRIC CO.,

MIANUS, CONN.

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**10,000 Receivers,** All compound magnet. Low price to reduce stock.

Electrose Receivers ..... 53c.
Hard Rubber Receivers ..... 63c.
Hunning non-packing Transmitters ..... 48c.
Hunning nickel-plated Transmitters ..... 60c.

Telephones and supplies of all kinds. Prices absolutely cash. All goods guaranteed.

CHICAGO TELEPHONE SUPPLY CO.,
Chicago. - - - - - - - - - - - Illinois.

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We Manufacture
**High Grade TELEPHONES.**
Complete Exchanges Installed.
**Northwest Engineering Co.,**
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# A NEW TELEPHONE MAGNETO BELL!

A NUMBER OF NOVEL FEATURES.
Write for illustrated description.

**Williams & Abbot Electric Co.,**
Mfrs. of Magneto Bells and Telephone Receivers. 9-11 Huron Street, CLEVELAND, O.

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342 DEARBORN STREET, CHICAGO, ILL.
....We Manufacture and Sell at Wholesale....
Magneto Bells, Receivers, Induction Coils.
WRITE FOR PRICES.

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**THE "ELGIN" TELEPHONES**
WORK ANY DISTANCE ON ANY WIRE.

Prices from $5 to $15 for the best Electric Telephones in the market.

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**THE TELEPHONE HAND-BOOK**
BY
HERBERT LAWS WEBB.
**Price $1.00.**

The only complete and practical work of its kind on the market.

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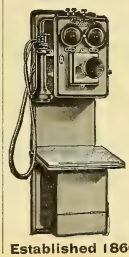

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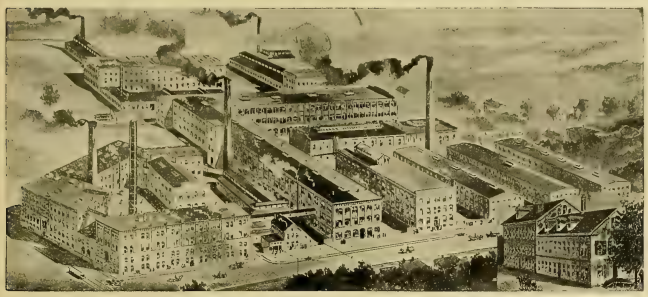

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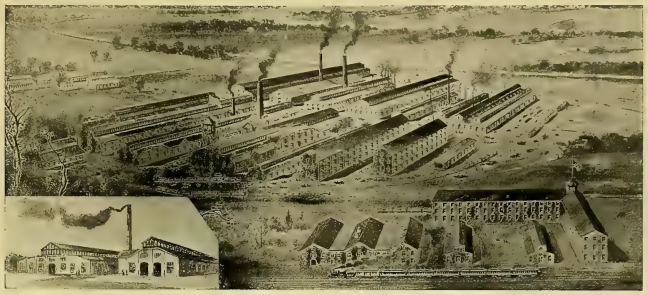

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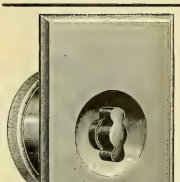

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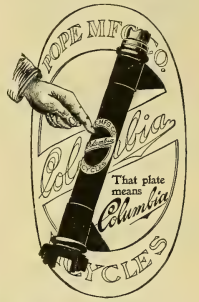


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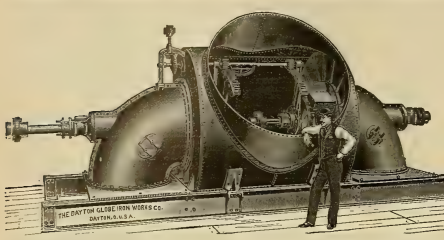


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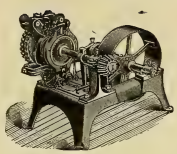

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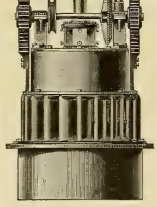

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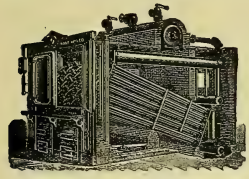

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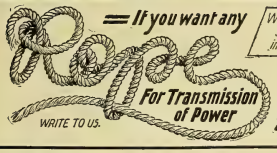

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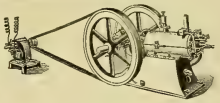

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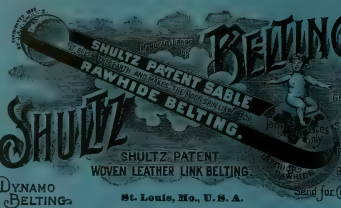


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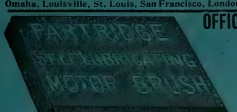


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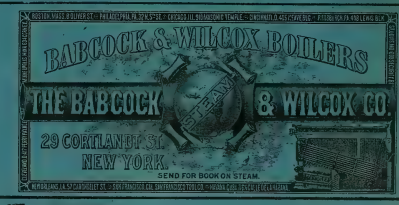

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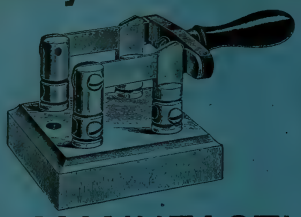

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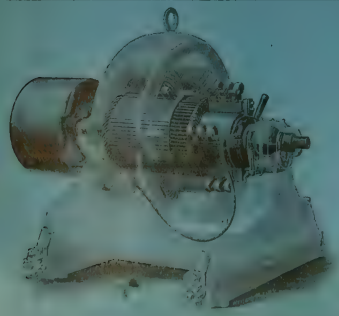

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Iron-Clad Armature, Self-Oiling Bearings, Carbon Brushes, Perfectly Noiseless and Sparkless. Three Speeds, and Fans in any Finish. Slow Speed, with all the Advantages of High Speed.

....WRITE FOR PRICES....

• • • •

**Western Electric Co.,**

....CHICAGO....

**ELECTRIC LAMP SIGNS....**

## NEW ERA IN ELECTRIC ADVERTISING.

Each lamp is a single letter, which greatly simplifies the construction of a sign, and permits an unlimited advertising display. This sign is low-priced, economical of operation, easily read, very conspicuous, and may be changed in a moment from one form of words to another. We manufacture High Grade Incandescent Lamps. Lamps of any voltage furnished.

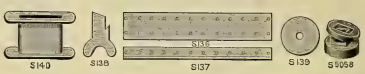
**Ask your NEAREST SUPPLY HOUSE for Sample or write**

## DICKINSON ELECTRIC SUPPLY CO.,

**High Grade Incandescent Lamps,**

American Tract Society Building, NO. 150 NASSAU STREET, NEW YORK.

## VULCABESTON CONTROLLER PARTS.




**All Controllers are Insulated with Vulcabeston.**

**G. E. 800 and Westinghouse Commutator Rings, Brush Holder Bushings and Field Spools.**

**SEND FOR PRICE LIST.**

Moulded Mica Trolley Insulating Materials, Frogs, Crossings, Tree Insulators, Weatherproof Sockets, etc.

**H. W. JOHNS MFG. CO.,**

**240-242 Randolph St., Chicago, Ill.**

Gen. Elec. Co. NEW YORK. PHILADELPHIA. BOSTON. Westinghouse.

## CARD

Generators for Power Transmission or Isolated Lighting.
CARD Generators are all Multipolar and Slow Speed.

**AGENTS WANTED IN UNOCCUPIED TERRITORY.**

75 K. W. GENERATOR.

## CARD

Multipolar Slow Speed Stationary Motors.
Reversible Motors and Controllers for Rolling Mills, Bridges and Traveling Cranes.

**THE CARD ELECTRIC COMPANY,**

**Office and Works, Mansfield, Ohio.**

MICA MICA MICA MICA

## JUST A____

**MICA** FOR ELECTRICAL INSULATION.

EUGENE MUNSELL & CO., Importers Direct from the Mines.

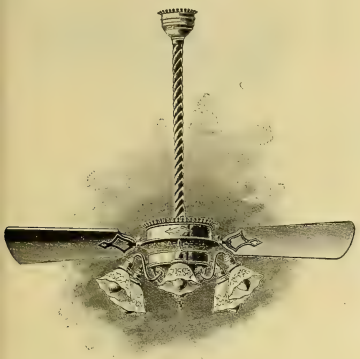
NEW YORK: 218 Water St. CHICAGO: 153 Lake St.

AGENCIES: CLEVELAND: Cuyahoga Supply Co. ST. LOUIS: A. S. Partridge. CINCINNATI: Sinclair Randall. SAN FRANCISCO: J. W. Brooke & Co.

MICA MICA MICA MICA

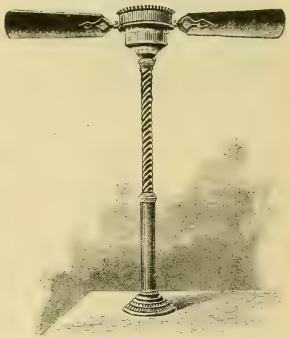
THE SEASON 1896.

# NEW DIEHL ELECTRIC FANS.



MANUFACTURERS OF

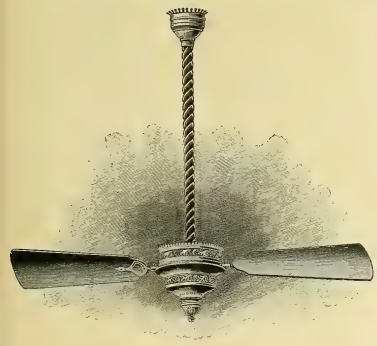
## The Original Direct-Connected Ceiling Fans.



TWO OR FOUR-BLADE FANS.

COLUMN, COUNTER COLUMN } FANS.

Exhaust Wheels.

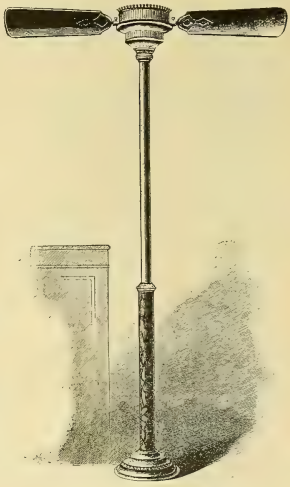


OWNERS OF

Fundamental Patents

COVERING SUSPENDED ELECTRIC

# Fans



FOR CATALOGUE AND PRICE LIST, ADDRESS

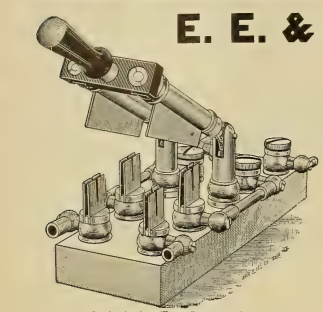
# DIEHL MANUFACTURING COMPANY,

ELIZABETHPORT, N. J.

SHOW ROOMS: 561 Broadway, New York.
128 Essex Street, Boston.

See our Exhibit at the National Electrical Exposition, Booths Nos. 118 and 119.

# E. E. & S. JACK KNIFE SWITCHES.



Switch for Top Connection.

We make these Switches regularly in all capacities from 25 amp. to 2,000 amp. Single, Double and Triple Pole. Single and Double Throw. With or without Fuse Terminals. Plain or Polished.

These designs with back connection are specially adapted for Switchboard use. The arm is made in a unique and practical way, insuring strength, good contact and handsome appearance.

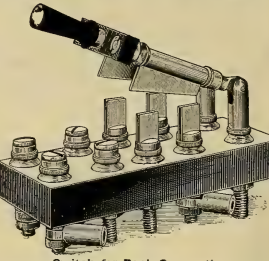
Our new list on these Switches is ready for distribution.

## Switchboard Building a Special Feature.

Send us your specifications and we will promptly furnish you with an estimate.

**We are still making a Complete Line of Incandescent Supplies, Street Hoods, Panel Boards, Snap Switches, Sockets, etc.**

**Electric Engineering & Supply Co.,**
**SYRACUSE, N. Y.**
New York Office & Storeroom : 27 Thames St. F. M. Hawkins, Agt.



Switch for Back Connection.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To read this advertisement
hold page to the light.


# THIS ALTERNATING CEILING FAN WORKS.

**We Guarantee It.**

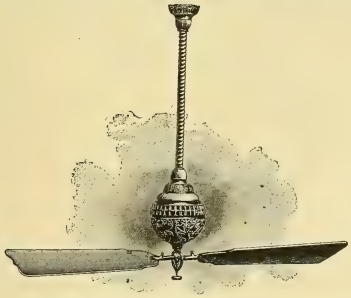
**No Commutator.**

**No Brushes.**

Uses Less Current than any Fan on the Market.

• • •

OUR DIRECT CURRENT FAN WORKS.



## Our Guarantee is Good.

Only Fan having Blade Adjuster.
Air can be thrown UP or DOWN.
All Bearings SELF-OILING.

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Ask for New Catalogue and Discounts, and you will send us an order.

The Handsomest Fan ever offered to the trade.

Fans Finished in Bronze, Nickel and Polished Brass.
We manufacture a full line of Belt Fans and Water Motors.

AGENTS WANTED IN LEADING CITIES.

## Hunter Fan & Motor Co.,

(Successors to Tuerk Water Meter Co.,)

FULTON, N. Y.

E. B. Latham & Co, Agents, 136 Liberty Street, New York.

We take this special method to announce that the word "SAFETY" in connection with INSULATED WIRE and CABLE stands for a product made famous by years of service in leading TELE-PHONE, ELECTRIC LIGHT, and STREET RAILROAD COM-PANIES in all the principal cities of AMERICA.

"SAFETY" Aerial, Underground and Submarine Cable

Is Proverbial for its Efficiency.

We have a unique SOUVENIR that we are presenting to our friends at the Electrical Exposition, which we will be pleased to send to all readers of this advertisement on mention of this paper.

The Safety Insulated Wire & Cable Co., 225 to 229 West 28th St., NEW YORK

# Sprague Electric Elevator Company,

**Postal Telegraph Building, New York City,**

**BUILDERS OF**

## Electric Passenger and Freight Elevators.

**The Multiple Sheave Screw Machine** Duplicates Hydraulic Service with less than half the water evaporation and coal expenditure.

It has any required speed and capacity. Each machine is an independent unit. Like parts are interchangeable. It has a superior down start. It occupies less space. It is absolutely safe.

**The Worm Gear Drum Machine** is for all classes of intermediate service. It is the most perfect machine of its type built.

**The Automatic House Elevator** is absolutely safe. It requires no operator.

Among typical buildings adopting Sprague Machines are:

Postal Telegraph Building, New York City; Parrott Building, San Francisco; Board of Trade, Chicago; Guaranty Building, Buffalo; Syndicate Building, New York City; Union Trust Building, Detroit; Gerken Building, New York City; Custom House, New York City; Merchants' National Bank, Baltimore; Hotel Walton, Philadelphia; J. T. Williams Office Buildings, New York City; Mabley Building, Detroit; Young Men's Christian Association, New York; Daniells' Stores, New York; Court House and City Hall, Minneapolis; Boston Daily Globe, Boston; Safe Deposit Building, San Francisco; Academy of Music, San Francisco; Canada Life Insurance Co., Montreal; State Mutual Life Assurance Co., Worcester; Johns Hopkins University, Baltimore; Edison Electric Illuminating Co., New York; Currier Bank Building, Los Angeles; Ahrens Building, New York; Wadsworth Building, New York; The Callender, McAuslan & Troup Company's Department Stores, Providence; the residences of Mr. John Jacob Astor and Mr. George Morgan, New York; City and County Court House, Salt Lake City; Graham Building, New York City; Mutual Benefit Insurance Co., Boston; Government Printing Office, War Department, Washington; Wilcox Building, Los Angeles.

Recent contracts include four of the finest and most costly buildings of their respective classes ever projected:

Manhattan Hotel, 9 Elevators. Siegel-Cooper Stores, 21 Elevators.
Commercial Cable Building, 21 Stories.
Mr. John Jacob Astor's New Palatial Hotel, 19 Elevators.

# "THE ELECTRA"

HIGH GRADE NUERNBERG CARBONS

FOR DIRECT CURRENT ARC LAMPS. FOR ALTERNATING CURRENT ARC LAMPS.

SEND FOR LATEST PRICE LIST TO

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**IF** you are anxious to secure the latest electrical books, **YOU** should write to the ElectricianPublishing Co., Chicago. You **CAN'T** procure too many reliable, readable books to **READ.**

# IMITATION IS THE HIGHEST PRAISE.

When we first offered enclosed arc lamps, doubters SMILED incredulously; NOW they are COPYING the "PIONEER," and while we appreciate this endorsement and the delicate compliment of imitation, we hereby give notice that we intend to

## STOP ALL INFRINGERS ON OUR PATENTS

And are pushing our suit in the U. S. Circuit Court against prominent users of other enclosed arc lamps. We trust this will be taken as fair warning to avoid litigation.

PIONEERS IN ENCLOSED ARC LIGHTING — THE PIONEER — TRADE MARK

## The Electric Arc Light Co.,

687 and 689 Broadway, New York.

LOUIS B. MARKS, M.M.E., CHIEF ELECTRICIAN.

The "Pioneer" Enclosed Arc Lamp burns 100 to 150 hours; saves $15 to $20 annually per lamp in carbon and trimming; is shadowless, noiseless, steady, simple and safe.

## THE WEST END STREET RAILWAY COMPANY OFFERS

# F-O-R S-A-L-E

**Six General Electric Multipolar 500 K. W. Generators; 4 Pole, Compound Wound, for 500 to 600 Volts.**

These Generators are complete, brass oil piping, brass fittings, marbleized slate panels, with apparatus for complete control and protection of generator. All in first-class order.

FOR FURTHER PARTICULARS AND PRICES, ADDRESS

**H. F. WOODS, = Purchasing Agent, = BOSTON, MASS.**

# SEVEN THOUSAND

Manhattan Arcs in service. One hundred Edison Central Stations. One pair of half-inch carbons will burn one hundred and fifty hours; will burn singly on incandescent circuits, avoiding the necessity of burning two lamps in series. A perfect diffusion of light is obtained by the use of double enclosed globes. Lamp is fire-proof and absolutely noiseless. Lamps to burn in series on circuits from two hundred to five hundred and fifty volts. Length twenty-four and thirty-seven inches.

# MANHATTAN

## Enclosed Arc Lamps.

Put in a new carbon and trim it once every one hundred and fifty hours. Figure what that will save you.

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**We have on hand five hundred Incandescent Arc Lamps of all makes, which we have displaced by "Manhattans," which we offer complete at $3.00 each.**

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## Manhattan General Construction Co.

NEW YORK: 44 Broad St. CHICAGO: Monadnock Block. BOSTON: 140 Congress St.

# The Warren Alternator.

**Induction Type** | Without Moving Wires. Without Collector Rings. Without Brushes.

**Any Voltage** 110 / 220 / 440 Volts without 1,000 / 2,000 / 5,000 Volts with **Transformers.**

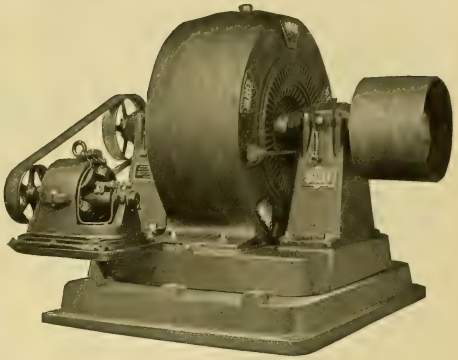
Stationary Single Ring Armature—Stationary Field Coil.

Revolvable Part a Solid Cylinder of Steel.

**EFFICIENCY THE HIGHEST** } Of any Alternating Current Generator known.
**REGULATION THE CLOSEST** }

NOISELESS IN OPERATION.

BUILT TO EARN MONEY WITH—NOT TO SPEND MONEY UPON.



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**SALES AGENTS:**

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**Bates Machine Co.,** 154 Congress St., Boston, Mass.
**A. M. Searles,** 281 Dearborn St., Chicago.
**California Electrical Works,** San Francisco, Cal.

# Central Station Repair Work Solicited.

I MAKE A SPECIALTY OF

## ARMATURES and COMMUTATORS.

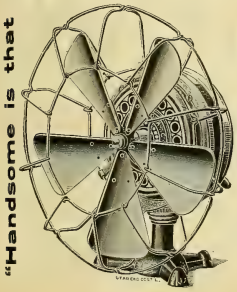
**Arc Lamp Supplies** IN STOCK OR TO ORDER.

**"American Wood"** SUPPLIES A SPECIALTY.

CHAS. J. BOGUE, 204 Centre Street, NEW YORK.

THE **EMERSON ELECTRIC MFG. CO.,**
ST. LOUIS, MO.,
And 112 Liberty St., New York.

"Handsome is that Handsome does."



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NOTE THIS
Current Consumption:

"Meston" 12-inch fan, 60 to 70 watts.
" 16-inch fan. 70 watts.
Induction 12-inch fan, 7,200 alts., 80 to 90 watts.
Induction 16-inch fan, 7,200 alts., 110 to 125 watts.
Induction 12-inch fan, 16,000 alts. .90 to 100 watts.

CHEAPEST
Fan Motors on the market because
BEST.

# A Good Thing 4-U-2-C.

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# PARTRICK & CARTER CO., PHILADELPHIA,

**Manufacturers of Electrical House Goods.**

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## *JUST NOW*

Is the time to decide on the Fan Motor you intend to handle this season. Our direct current motor is equal to the best, if its intrinsic merit is considered.

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**Of all Descriptions.**

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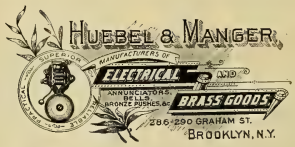


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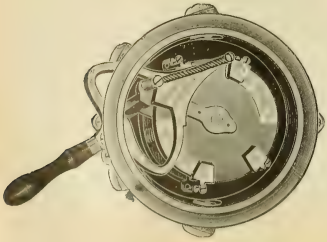
# Disc Arc Cut-Out.



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Water Tight Iron Case. Perfect Insulation.

**ORDER ONE. YOU WILL USE MORE.**

General Repairing.

Single and Double Pole Iron-Box Fuse Boxes. Arc Knife Switches. Lightning Arresters. WRITE US. GET OUR DISCOUNTS.

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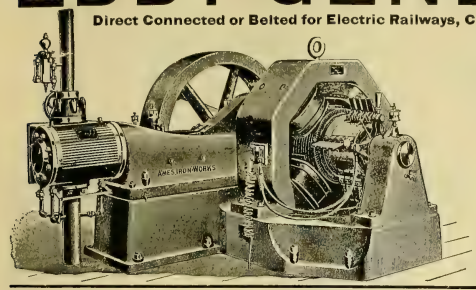
# EDDY GENERATORS.

**Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.**



**Eddy Motors—Slow, Medium or High Speed.**

We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.

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We are making the very best Carbons now on the market, and selling them at prices that you cannot afford to remain unaware of. Operating as we do the largest factory outside of the "Trust," with a daily capacity of 150,000 carbons, the prompt execution of large orders is assured.

## THE AMERICAN CARBON CO.,

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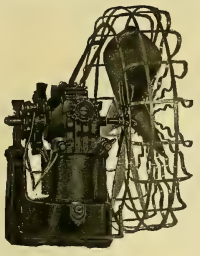

*LOTS OF OTHER FAN OUTFITS*

# BUT!!!

The C-W FAN OUTFITS have 6 BLADE, 12 and 16-INCH FANS instead of the usual 10 and 15-inch 4 Blade.

They will therefore do **BIG WORK** if you want it.

The Fan guard is ornamental and substantial and close enough mesh to prevent a Fan blade from flying out should it, by chance, be broken while in operation.

The complete Fan Outfit may not address itself to your eye as pleasantly, as to design and shape, as some others, it having been considered unwise to sacrifice stability to enhance its appearance.

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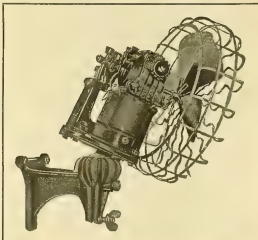
**39 and 41 Cortlandt St., New York.**



WE tell you here only about FANS. This is the FAN SEASON. We also manufacture "The Best" in Dynamos and Motors of Standard and Special Types in all practical sizes. If interested in these please write us. . . . . .

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Are becoming daily more popular.

**Series Arc, Direct Current, and Alternating Current.**

CONSTANT POTENTIAL CIRCUIT. Write us about our new 30-HOUR Lamp—a beauty.

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# RAINBOW SHEET PACKING.

HAVE YOU USED IT?

Oils, Ammonia or Alkalies do not affect it.

Steam Joints Made Instantly.

NO BAKING OR FOLLOWING UP.

Patented and Manufactured Exclusively by

PEERLESS RUBBER MFG. CO., 16 Warren Street, New York.

OUR ALTERNATING

## Current Ammeters

....AND....

## VOLTMETERS

FOR SWITCH-BOARD WORK

are superior to anything on the market, and our prices—well, write to us and we will tell you all about them.

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COPPER AND STEEL.

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"VOLTA DYNAMO" Belting is Superior!

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There's nothing like Leather. It brings the money.

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OUR MOTTO IS:

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ARE SUPERIOR IN QUALITY.

WE make them—YOU need them.
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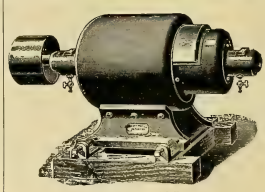
**SAMSON SPOT CORD**

For Arc Light and Trolley Cord.

SAMSON CORDAGE WORKS, - BOSTON, MASS.

# THE STOREY MOTOR.



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- Specially adapted for direct driving machinery.
- The application of Motors to machine tools a specialty.
- Light weight. Slow and medium speed.
- No interior magnetism.

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# The Best Money

A central station earns is that which comes from **increase of day load.**

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Earn this kind of money. These devices and other electrically heated devices (all of which are guaranteed) are made by the

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Clusters, Flanges,
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# The Only Water-Wheel Governor that Governs.

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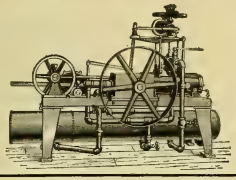
GENTLEMEN:—We have one of your Governors in use at our power house at Millers Falls, Mass., taking care of two water-wheels to perfection, regulating the power *within a few volts*. We took out one Governor and replaced it with a LOMBARD GOVERNOR which gives *perfect satisfaction*. Yours truly, MONTAGUE ST. RY. CO.,
(Signed) H. C. GARFIELD, Supt.



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Send us a description of your water-wheel plant.

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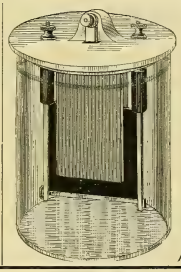
**We manufacture one of the best and handsomest Needle Annunciators. Write us for prices.**



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Long Life, Efficiency,
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It is absolutely Non-Freezing.
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Superior Generation of Energy.

These Batteries are in use by the most prominent Telephone, Fire Alarm and Railroad Companies of America.
Send for descriptive circular and price list. We guarantee all our Cells.

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All around man for Street Railway or Electric Light. Good Engineer and Machinist and first-class Electrician; any system. Familiar with making tests, repairs and construction work. Address "H." care WESTERN ELECTRICIAN.

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A party with money to take either the controlling interest or the whole deal of an electric light plant in a town of 2,000. Have franchise but not enough money to install same. Address "220," care WESTERN ELECTRICIAN.

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An energetic business man to investigate a concern manufacturing electric motors and dynamos where money can be made, as the machines are the best, have been well introduced, a large number now in operation. They can be turned out as cheaply as any of the others, and all that is wanted is more capital and a good business man with it, who will take entire charge of the management of the concern, employ his own help without interference, become a director in the company, and look after his own investment.

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A controlling interest in an electric light plant, located in the most prosperous city of its size in Central Illinois, is offered for sale at a great bargain. Forty-five arc and 3,000 incandescent lamps in circuit. City contract 3 years to run. Only plant in the city. Business growing rapidly. Coal delivered at the boilers for 35 cents per ton for slack, 90 cents for lump. Capital stock $20,000, no bonds. Twenty per cent. earned last year. Good reason for selling. Address for further information. "Dynamo," WESTERN ELECTRICIAN Office.

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One 600 h. p. Corliss engine, one 300 h. p. Corliss engine; one 300 h. p. Westinghouse compound engine; one 250 h. p. Ball automatic engine; two 125 h. p. Ball automatic engines; two 80 h. p. Ball automatic engines; two 125 h. p. generators, 500 volts; four 60 h. p. generators, 500 volts; large stock of automatic engines and dynamos of every description. Also a battery of compound boilers, 750 h. p., 160 h. p. in a pair. FRANK TOOMEY, 131 N. Third Street, Philadelphia.

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One 1,000 light incandescent dynamo and one 500 light incandescent. Both direct current, compound wound.

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234 E. Lake Street,
CHICAGO.

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One 150 Light Mather Incandescent Machine with Spare Armature.
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Practically new, in A1 condition.

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Bids will be received by the City Clerk and opened by the undersigned at 12 m. June 5th, to light the streets of San Antonio with arc electric lights, as per specifications to be had on application to the City Engineer of said city.

The City of San Antonio reserves the right to reject any and all bids.

(Signed) HENRY ELMENDORF, Mayor.
ATTEST: E. R. NORTON, City Clerk.

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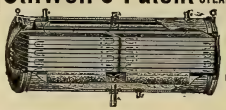

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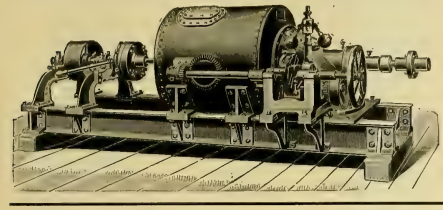

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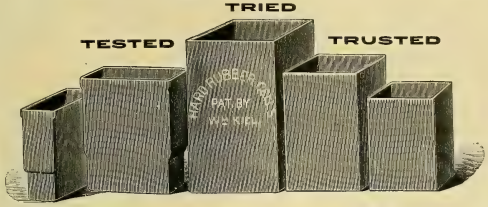

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SWITCHES. SWITCH BOARDS. TABLET BOARDS.

LOCAL AND LONG DISTANCE TELEPHONE COMMUNICATION

123 North Third Street,

Philadelphia, Pa., May 6 1896

The ''Western Electrician''

Chicago Ill,

Gentlemen:-

We have just received your May 9th, number, and although it is not requested by personal letter to us we can not but help to tender to you our congratulations upon the appearance of this paper.

And in this same letter we wish to take an exception to an item in your own advertisment on page (xii) Fact #3 ''West of the Alleghanies'' should not appear. We are pretty near as far East of them as we can get and we receive the W.E. as soon as any other paper, and this particular number before the most of them in fact all except Electricity.

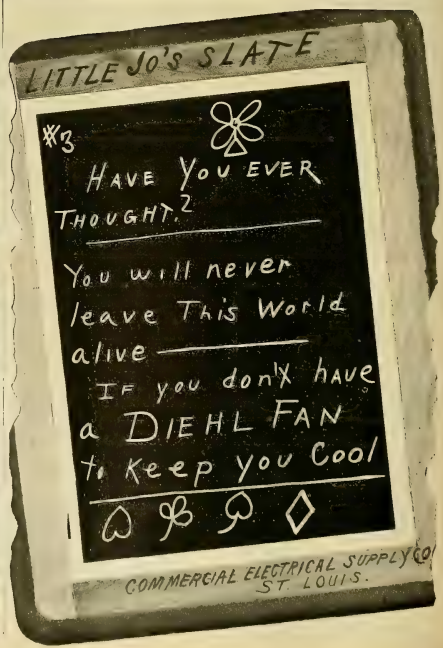
Don't be too modest.

Again congratulating you we are

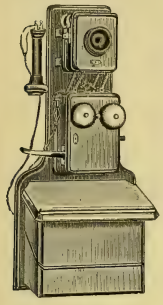
Very truly yours

Dic. by G. T. E.

Evanson & Armpriester



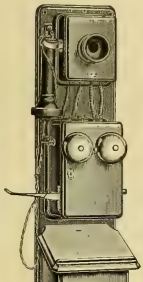
# VIADUCT MFG. COMPANY



Is the **oldest** concern of the kind in this country, with one exception, manufacturing

**Magneto Bells, Telephones, District Telegraph Messenger Boxes**

and other appliances.



It has had 18 years' experience; 5 years as licensed manufacturer of the American Bell Telephone Company. It has made more Magneto Bells than all the other manufacturers in the country. Its standard work is known by all experienced telephone men.

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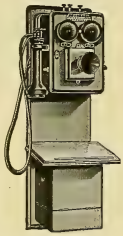

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**Will ring bells on long lines of high resistance. Will ring a large number of bells in series on short lines. Will ring on a line various makes of bells with different windings. Will work with any make of switchboard. Will drop a shutter on long lines, etc., etc.**

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**The price,** as well as the instrument is small. We always make low prices on our specialties, in order to make them up in quantities.

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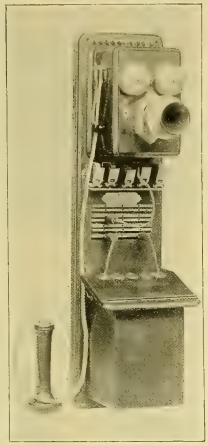
# MAKE AND BREAK TELEPHONES

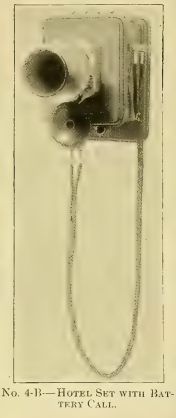
## DO NOT INFRINGE THE BERLINER OR ANY OTHER PATENT.

There is a wide and profitable field for the employment of capital in competing with the Bell Company for telephone business, providing always that the instruments used do not infringe any of the numerous Bell Company patents either on telephones or switchboards. The most important patent is unquestionably the famous Berliner, now in abeyance pending the decision of a suit in the United States Supreme Court. This patent is so broad as to absolutely exclude all battery transmitters except the M. & B. If the Supreme Court *confirms* the decision of the Court of Appeals, which is highly probable, every battery transmitter now manufactured, except the M. & B., is an infringement of that patent, and persons who have been led to invest money in the installment of telephones where these transmitters have been used will not only be liable to lose their investment, but to be mulcted in damages besides. It is absurd to assume that the Bell Company will quietly stand by and see the field occupied by competitive companies, when it is in their power to close every one of them. In view of these unquestionable facts, it behooves capitalists and others who contemplate investing money in telephone enterprises to secure a system which is protected by patents quite as broad as those of the Bell Company—a system entirely free from any possible complication with the Berliner patents. Such a system is the M. & B., which affords perfect protection to capital, at the same time providing the most efficient telephone that modern science has yet evolved.

The M. & B. instruments differ from the many imitations of the Bell type, which are merely attempts at evasion, copies of the earlier forms of mechanism, long since discarded by the Bell Company, or ingenious equivalents of the later microphone instruments, one and all of which are infringements of the basic Berliner patent, which covers fully all such types. The M. & B. Telephone, so far from conforming to the Berliner idea, is the exact opposite of it, and is a pronounced advance in the art of telephony; it is to-day the highest product of that art. As we are not obliged to consider the Berliner patent, our method being its exact opposite, and having nothing in common with it except the end sought to be attained—the transmission of speech—our transmitter conforms exactly to the simplest and most direct method of obtaining the maximum results possible to the art. No complex mechanism or indirect approaches are necessary to avoid encroaching upon the claims of the Berliner patent. We move on straight lines only. This results in a transmitter as simple in construction as it is effective in use, and thus secures the maximum possibilities of the art. Our method also results in the very desirable quality of continuous efficiency, the life of which is only to be measured by the life of the instrument itself.



No. 3.—Station Telephone Set for Factories or Small Towns.



No. 4-B—Hotel Set with Battery Call.

No. 6.—Desk Set.

Another striking peculiarity of the M. & B. is its ability to overcome induction, which is the result, not of any special device, but of the conformation of the transmitter.

In order that our instruments shall be durable and reliable, and possess the highest qualities of excellence during a long period of service, only the best material is used throughout, while the workmanship is of the highest class and under constant expert supervision. So sensitive and delicate an instrument as a high-class modern telephone can not be produced cheaply, and we make no attempt to compete with the output of cheap telephones, with which the market is already overstocked. We are filling orders daily for 'phones to replace these crude and unsatisfactory instruments.

We manufacture six standard styles, which cover the entire requirements of the business, viz.:

No. 1. Long-Distance, Double-Battery 'Phone for trunk lines and long-distance service, guaranteed for 1,000 miles.

No. 2. Standard Exchange 'Phone for exchange work in towns and cities, also for private lines.

No. 3. Station Telephones, with switchboard attachment, twenty connections or less.

No. 4. Interior Sets for hotels, factories, public buildings, etc. Intercommunicating connections where required. With Magneto or Battery Call.

No. 5. Magneto Call Set, same as the Exchange 'Phone, but without backboard and battery box.

No. 6. Desk Sets for offices, etc.

We also furnish Switchboards of our own design and manufacture, non-infringing in every detail, and adapted to every description of exchange work.

Correspondence is solicited. Persons contemplating the organization of telephone companies will find it to their advantage to confer with us either personally or by letter.

**The United States Telephone Construction Company,**
**372 and 374 The Bourse Building,**
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P. S.—Our new illustrated catalogue will be issued about May 10.

---

### BRIEF EXTRACTS FROM THE WRITTEN OPINIONS OF LEADING PATENT LAWYERS.

* * * Here let me state that up to the present time the Bell Company have had ONLY CONSTRUCTION PATENTS to contend with, and these, without exception, using the BELL METHOD, and having nothing but the single MECHANICAL CONSTRUCTION for the defense.

Now for the first time since telephoning became a necessity, appears a new method that a "Make and Break"—in other words your METHOD of pulsatory or interrupted circuit.

Let us look at its work, examine its action, compare it with the Bell, and I stake my legal opinion upon the assertion that no court in the United States (were Bell to attack you) but would sustain your METHOD and PATENT.

The fact of your having a strong METHOD patent granted upon a new theory and demonstrated physically in its action as a "Make and Break" circuit telephone, both by instantaneous photographing as well as by the use of a Western Union sounder in the battery circuit, is enough to warrant the opinion that you need not fear the Bell Company in court, but should an attack ever be made you will have with you in your support the scientific force of more than twenty Universities in the United States, and the sympathy of thousands upon thousands of the business men of the country.

I have noticed in your Telephone three important features, each being unlike any other telephone within my knowledge:

FIRST. Perfect articulation.

SECOND. Absence of induction.

THIRD. Full volume of voice.

These three points are of themselves of great weight in establishing the difference of method between you and Bell.

Heretofore the test has been between Bell's method and other inventors' mechanical construction.

If Bell ever attacks you it will be method against method, and you will have the scientific men of the nation with you.

It is my opinion, based upon a thorough acquaintance with the Patent practice, and particularly that relating to the electrical department, that your patent for method, as well as your different construction allowed, can and will be sustained in court.

M. F. HALLECK, Washington, D. C.

* * * Any multiplication of words in this connection would be superfluous, and my opinion is that the M. & B. Telephone does not infringe the Berliner patent. In fact, the situation, when correctly understood, does not admit of any other conclusion.

JOHN McDONALD, New York City.

Complying with your request that I should express in briefer form my opinion, I would say, in the first place, I am clearly and positively of the opinion that a telephone working in the manner described in Bonta's patent would not infringe the Berliner patent; and, in the second place, even if the Bonta telephone did, in fact, and contrary to Mr. Bonta's description, work, in part, at least, by means of variable resistance of the circuit, I am still of the opinion that the telephone would not infringe the Berliner patent, provided, as a matter of fact, the breaks in the circuit were even approximately as long and frequent as they would appear to be from Bonta's specification, and from the *experiments tried in the Patent Office before the patent was granted.*

Very truly,

FRANCIS T. CHAMBERS, Philadelphia.

**NORTH-CENTRAL TELEPHONE CO., - 210 Lumber Exchange, Minneapolis, Minn.**

# LE ROY'S IMPROVED ALUMINUM X-RAY FLUOROSCOPE.

FOUR TIMES AS SENSITIVE AS ANY YET MADE.

Low Price, High Quality. | Complete Portable X-Ray Outfits for Physicians | Goods Guaranteed. Weight 6 Ounces.

AND OTHERS DESIRING AN OUTFIT FOR EXPERIMENTAL USE.

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# HART FLUSH SWITCHES.

New Face Plate.

BETTER PROPORTIONS. BETTER FINISH. MORE DURABLE.

Made of solid plate brass $\frac{1}{8}$-inch thick, with beveled edges.

Better Design, Better Material, Self-Adjusting Handle, No Breaking,

No Binding on Face Plates,
No Loose Face Plates.
Handles, Switches and Face Plates Interchangeable.

Single Plates for all sizes of Hart Switches.
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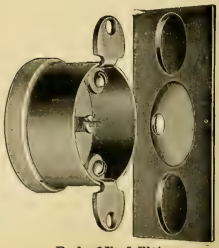

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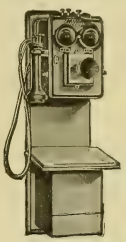

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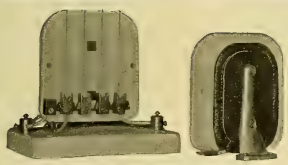

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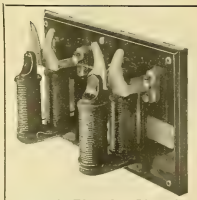

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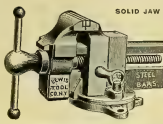


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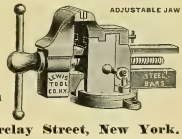


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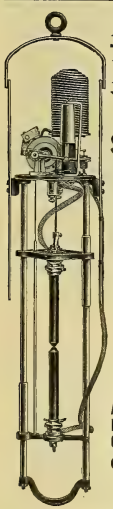

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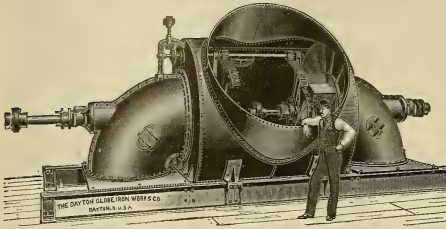


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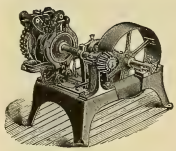

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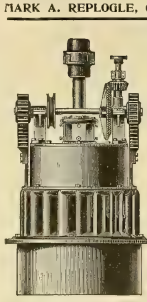

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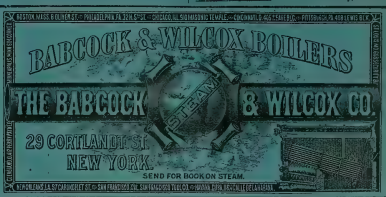


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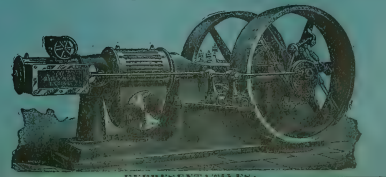

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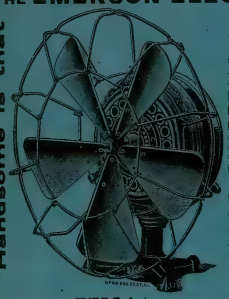

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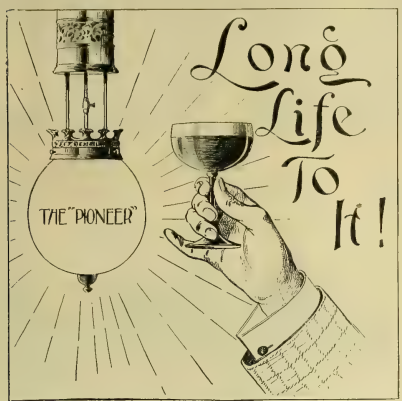


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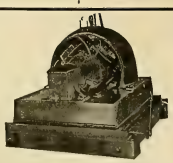

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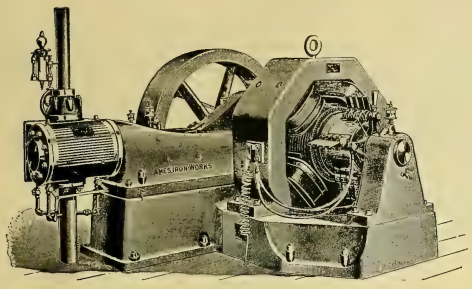

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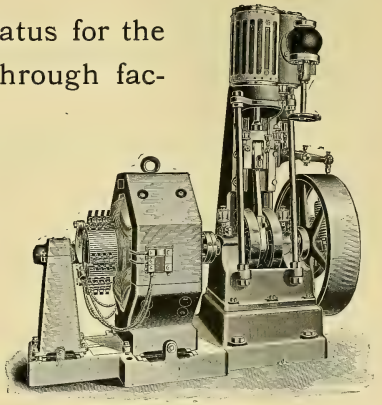

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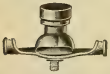

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Electric Storage Battery Co.
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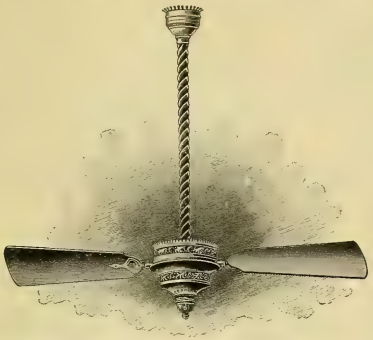

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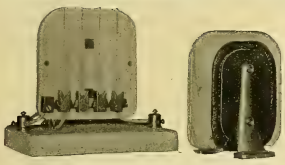

Magnetic Blow-Out Lightning Arrester for Alternating Current Circuits--Interior View.

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For Lighting, Power, Railway and Long Distance Transmission Circuits, Direct or Alternating Currents.

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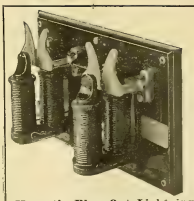

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**We Guarantee It.**

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**No Brushes.**

Uses Less Current than any Fan on the Market.

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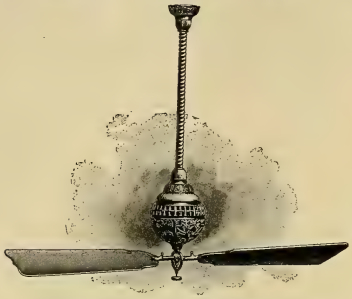

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Air can be thrown UP or DOWN.
All Bearings SELF-OILING.

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The Handsomest Fan ever offered to the trade.

Fans Finished in Bronze, Nickel and Polished Brass.
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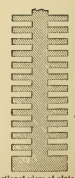
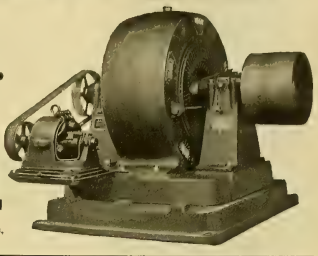


Sectional view of plate.

# The Warren Alternator.

**INDUCTION TYPE** | Without Moving Wires. Without Collector Rings. Without Brushes.

## Any Voltage 110 220 440 Volts without 1,000 2,000 5,000 Volts with Transformers.



STATIONARY SINGLE RING ARMATURE—STATIONARY FIELD COIL.
Revolvable Part a Solid Cylinder of Steel.
Efficiency the Highest, Regulation the Closest, of any Alternating Current Generator Known.
Noiseless in Operation. Built to Earn Money With, not to Spend Money Upon.

## WARREN ELECTRIC CO., CHICAGO.

SALES AGENTS:
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A. M. Searles, 281 Dearborn St., Chicago.
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## DALLETT
## Electric Motors and Generators,

MANUFACTURED BY
**THOS. H. DALLETT & CO.,**
York St. and Sedgley Ave.,
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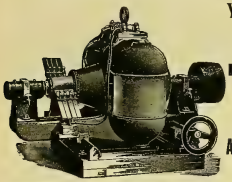

Portable Electric Drills,
Starting Boxes and Controllers,
Automatic Switches.....
Flexible Insulated Couplings.

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PLAIN, ORNAMENTAL,
For Direct and Alternating Current.
Write for Catalogue.

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TO THOSE INTERESTED IN ELECTRIC LIGHTING.

If you haven't read Buckley's "ELECTRIC LIGHTING PLANTS; THEIR COST AND OPERATION," you should order a copy at once. It is the only work of its kind in print and will prove an inseparable companion. It is just the book thousands of men have been waiting for; it will be what you want. 275 pages. Illustrated. Cloth, $2.00. Paper cover, $1.00. Postage free.

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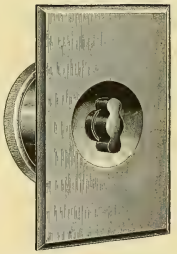

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Solid Face Plate,
Beveled Edges.
All Sizes of Hart Switches.
GANG PLATES FOR ANY NUMBER.
Self-Adjusting Handle.
NO BREAKAGE.

Always the Right Pressure on Face Plate.

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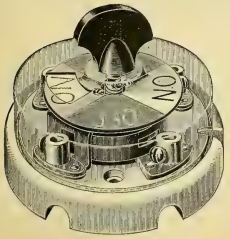
# THE PERKINS DIAL SWITCH.




For current of from 5 to 50 amperes, and as high as 500 volts.

Shows when current is "ON" or "OFF." Handles a street railway current for lights ....or car heaters....

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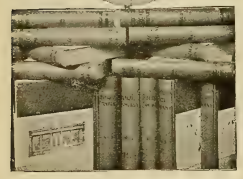

# In Preparing This New Catalogue

We have been mindful of the needs of all our customers, and our sole aim has been to publish that which would prove helpful and serviceable to all who purchase electrical material of any kind. Our friends kindly say that we have not only achieved this purpose, but describe it as the "largest, handsomest and most complete electrical supply catalogue ever issued," "an encyclopedia of all other catalogues," "a reference book of everything electrical."

**Send a small order and receive a copy.**

## METROPOLITAN ELECTRIC CO.,

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Fan Motor you intend to handle this season. Is the time to decide on the best, if its intrinsic merit is considered. Our direct current motor is equal to

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MAGNETO, HAND AND POWER

**...GENERATORS...**

**INDUCTION AND SPARK COILS, ETC., ETC.**

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## TABLET BOARDS, SWITCHES AND SWITCHBOARDS

of all descriptions.

WRITE FOR OUR NEW CATALOGUE D.

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Formerly J. Grant High & Co.,

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NEW YORK, 136 Liberty St., Chapin & Douglas.
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## New Dynamo Tenders' Hand-Book.

By F. B. BADT.

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**Electrician Publishing Co.,**
**Suite 510 Marquette Building, CHICAGO.**

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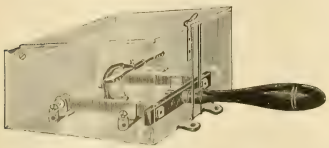
# Arc Knife Switch.



NO SPRINGS TO BREAK.

ALWAYS RELIABLE.

**ORDER ONE, YOU WILL ORDER MORE. GENERAL REPAIRING.**

Incandescent and Power Knife Switches, Lightning Arresters.

**Write Us. Get Our Discounts.**

**SINGLE AND DOUBLE POLE IRON-BOX FUSE BOXES.**

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# THE PORTER STANDARD MOTOR CO.,

Manufacturers of the only genuine "PORTER MOTOR."

Beware of Imitations. Our Battery Motors are second to none in workmanship, finish and general efficiency. Every Motor Guaranteed. We are the pioneer makers of Small Battery Motors. You can obtain our Motors from any Electrical Supply House in the country. . .

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Our factory was recently burned out, you know—note change of address.

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## THE AMERICAN CARBON CO.,

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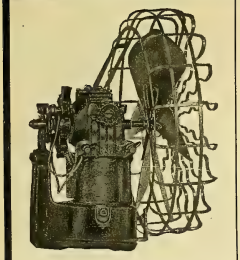

*LOTS OF OTHER FAN OUTFITS*

# BUT!!!

The C-W FAN OUTFITS have 6 BLADE, 12 and 16-INCH FANS instead of the usual 10 and 15-inch 4 Blade.

They will therefore do **BIG WORK** if you want it.

The Fan guard is ornamental and substantial and close enough mesh to prevent a Fan blade from flying out should it, by chance, be broken while in operation.

The complete Fan Outfit may not address itself to your eye as pleasantly, as to design and shape, as some others, it having been considered unwise to sacrifice stability to enhance its appearance.

If you want a Fan Outfit for this season and will want it again next season, and several following seasons, you want the C-W. Let our Selling Agents talk to or write you.

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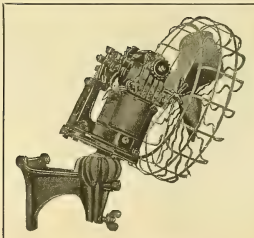
MANUFACTURERS AND ELECTRICAL ENGINEERS,

**39 and 41 Cortlandt St., New York.**



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This is a block or tablet of Current Indicator Reports, a blank form on which can be recorded the station record of the number of amperes of current, as shown by the station ammeter, every thirty minutes during the entire twenty-four hours.

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A complete set of Architects' Specifications for electric wiring. These specifications have been carefully prepared by a well known consulting electrical engineer, and form a model set of specifications which can be profitably followed on all contracts for electric wiring. Either or both of the above mailed free on application.

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## PEERLESS SPIRAL Piston and Valve Rod PACKING

Expressly for High Speed Engines. Will Hold 400 lbs. Steam.

20 YEARS OLD AND NO EQUAL.

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COPPER AND STEEL.
(JOHN A. ROEBLINGS' SONS CO., Makers.)
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Send for descriptive pamphlet.

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Describing the
HOYT STATION AMMETERS AND VOLTMETERS
Sent free on Application.
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For Arc Light and Trolley Cord.

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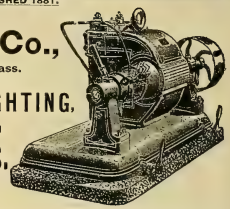

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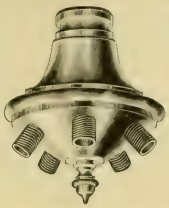

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The Clark Wire has been before the public and in use for the past nine years, and has met with universal favor. Thousands of miles of this wire have been sold, and are in use throughout the United States and Foreign Countries, and the demand for it is constantly increasing, because it always gives perfect satisfaction.

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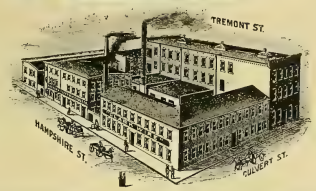


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We shall be pleased to mail Catalogues with Terms and Discounts for Quantities.

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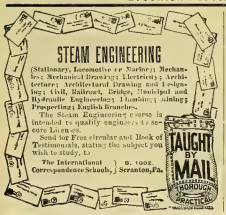


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EXCELS IN

Long Life, Efficiency,
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It is absolutely Non-Freezing.
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Send for descriptive circular and price list. We guarantee all our Cells.

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By a salesman of ability, with clean record, sober and industrious, well versed in electric machinery and supplies, competent to figure, contract and engineer construction work, superintend and install lighting and electric power plants. Good references. Address

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L. A. HINE & CO.,
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A rare opportunity is offered to purchase a modern factory well equipped with a full line of machinery, tools and patterns used in the manufacture of a well known and successful make of dynamos and motors. The factory is located within 100 miles of Chicago, in a thriving railroad center and manufacturing town of 30,000 population. The electrical machinery now being manufactured is simple in construction and operation, and has been successfully on the market for several years.

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A 1,300-light Fort Wayne Alternating Incandescent Dynamo, with Exciter. Second-hand, but in perfect order. Address

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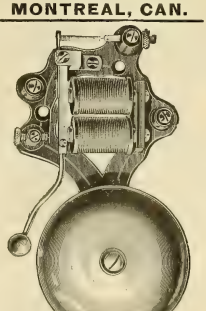

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HUEBEL & MANCER,
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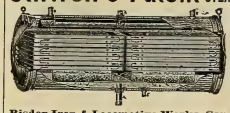

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Poles for Railway, Telephone, Telegraph or Electric Light Plants. Standard Norway Pine, Painted Cross Arms and Oak Pins.

Six large sorting pole yards in Michigan. Get prices on first grade poles for city construction and buy of an old reliable firm.

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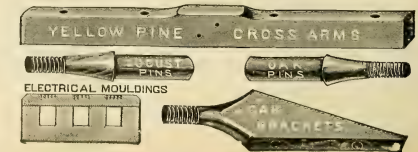

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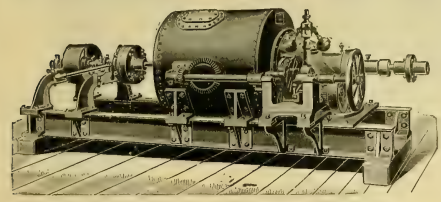

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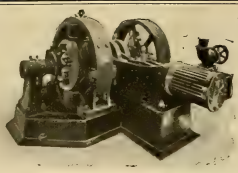

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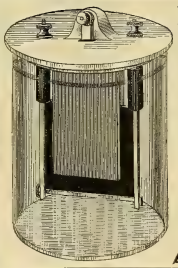

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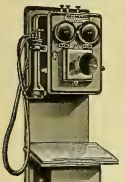

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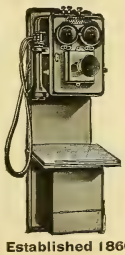

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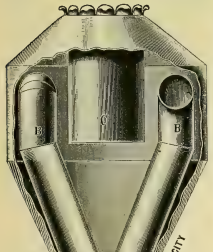


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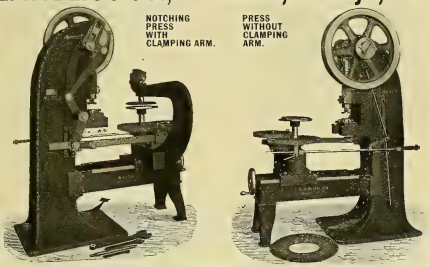


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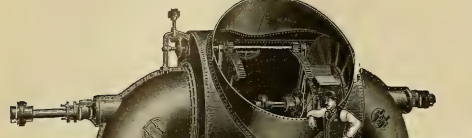


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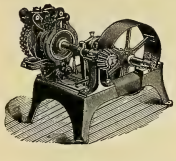

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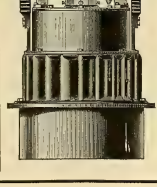

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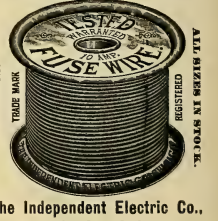


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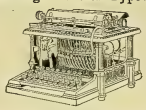

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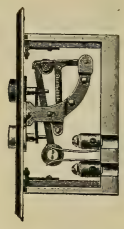

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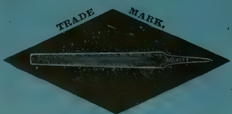

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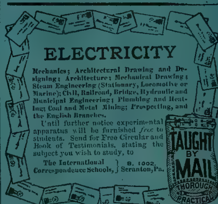

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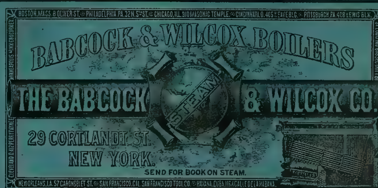

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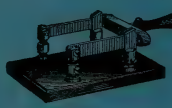

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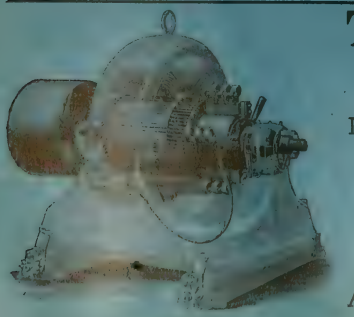

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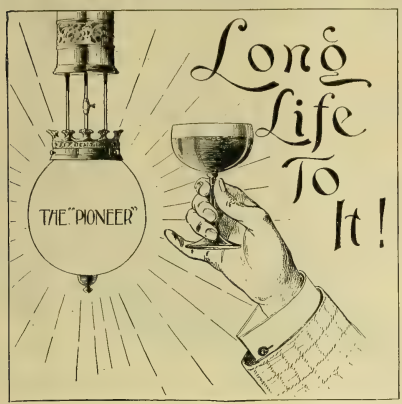


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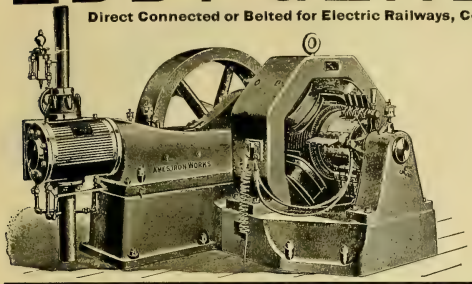

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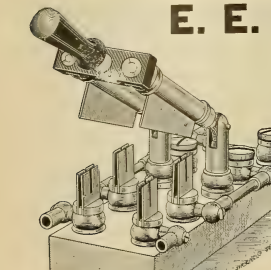

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These designs with back connection are specially adapted for Switchboard use. The arm is made in a unique and practical way, insuring strength, good contact and handsome appearance.

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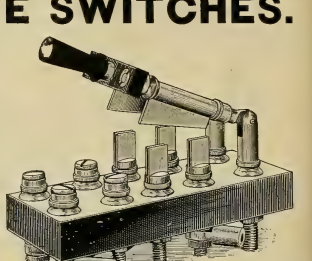

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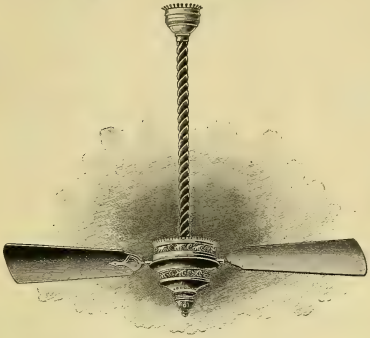

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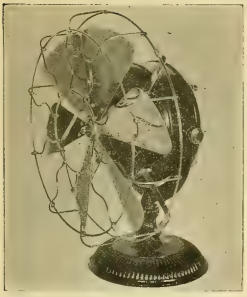
# FAN MOTOR

FOR TABLE, WALL OR CEILING.



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Vertically or Horizontally.

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| 52 Volts | -- | 104 Volts |
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NO BRUSHES, NO COMMUTATOR,
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12 inch Fan, 1,800 Revolutions.
Immediate Delivery.

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Made of solid plate brass ⅛-inch thick, with beveled edges.

Better Design,
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No Breaking,

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Handles, Switches and Face Plates Interchangeable.

Single Plates for all sizes of Hart Switches.
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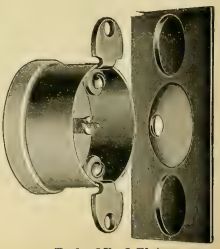

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They are made throughout of the very best materials obtainable.

They are made from **start** to **finish** by **skilled** workmen and are mechanically perfect.

They are carefully and thoroughly tested by means of instruments made **especially** for the purpose, and **ONLY PERFECT** Lamps are allowed to leave the factory.

They are **uniform in efficiency, voltage** and **candle-power** and are fully guaranteed.

They are of **HIGH EFFICIENCY** and you will **save money** by **using them.**

They are **not** the **lowest priced** lamps on the market, but **they ARE** the **CHEAPEST** lamps obtainable, if the **ratio of light given off** to **the current consumed** is taken into consideration.

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OF ALL KINDS.

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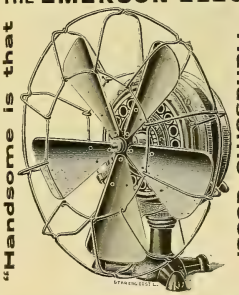

TYPE E. I. 1.

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Current Consumption:

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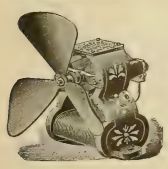

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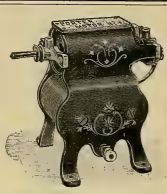

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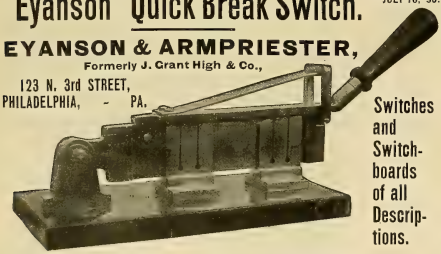

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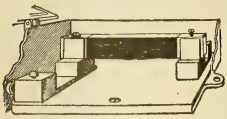

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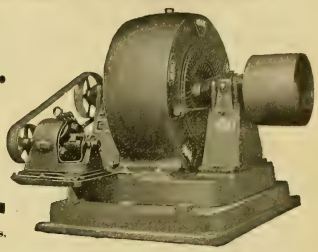

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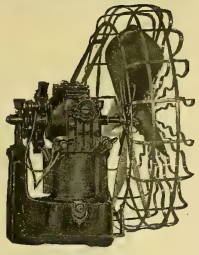

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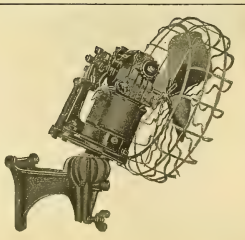

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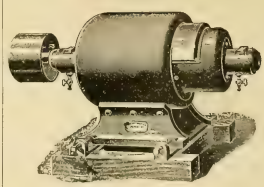

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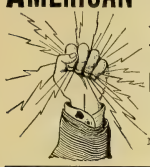

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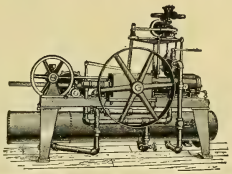

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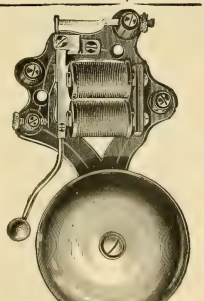

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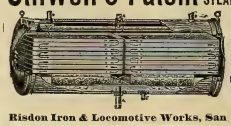

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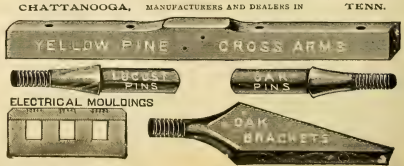

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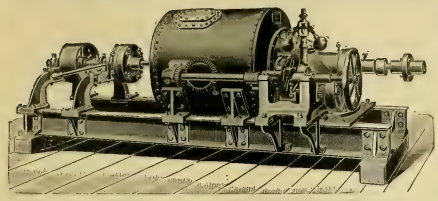

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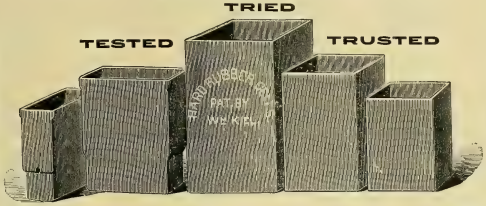


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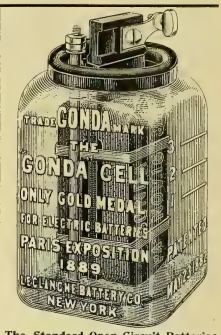


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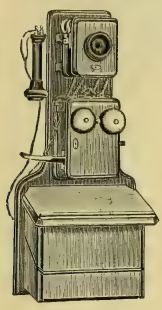

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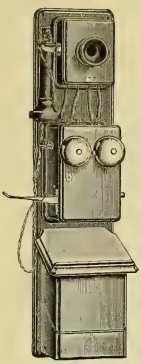

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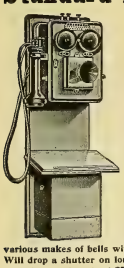

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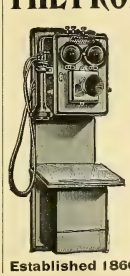

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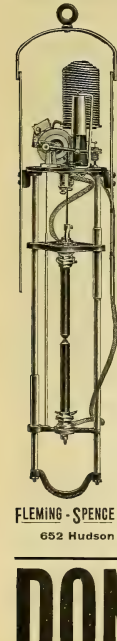
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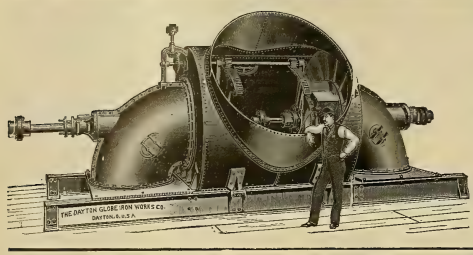


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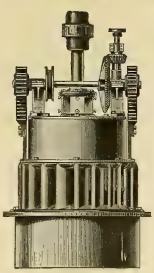

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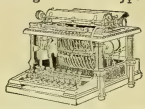

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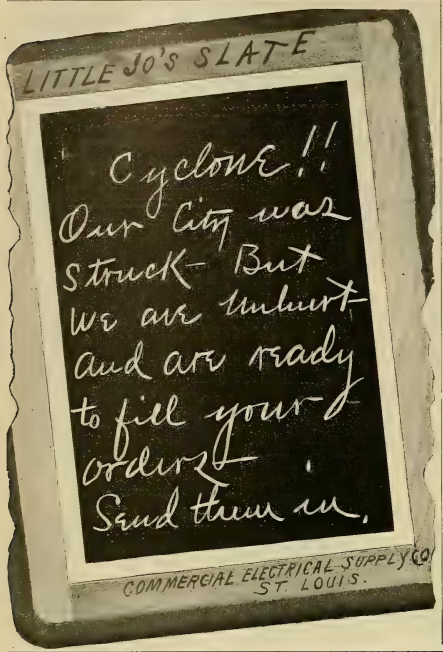

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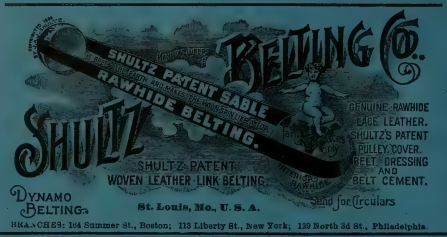


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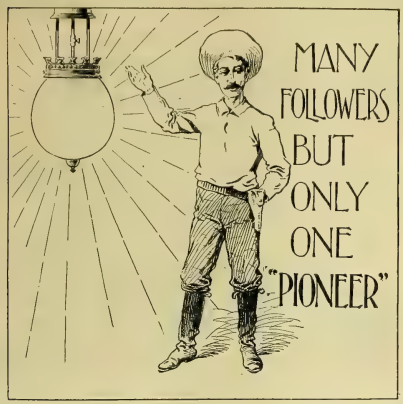


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# HARDTMUTH CARBONS,

**Cored and Solid for Direct Lighting.**

## ...LARGE IMPORTATION JUST ARRIVED...

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**..DEALERS IN ELECTRIC LIGHTING SUPPLIES..**

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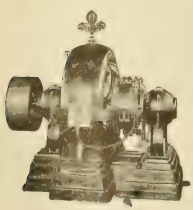

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**CARD** Multipolar Slow Speed Stationary Motors. Reversible Motors and Controllers for Rolling Mills, Bridges, Traveling Cranes and Elevators,

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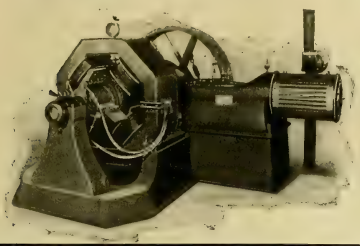
**Direct Connected or Belted for Electric Railways, Central Stations, Isolated Lighting or Power Plants.**



Eddy Motors—Slow, Medium or High Speed.

**We build all necessary apparatus for the transmission of Electrical Power through factory or other buildings.**

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KANSAS CITY, W. T. Osborn.
CINCINNATI, O., Nevada Bldg., John A. Stewart.
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## Electric Motors and Generators,

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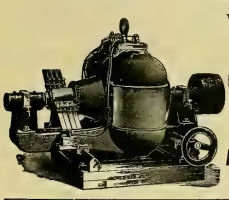

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Solid Face Plate,
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**All Sizes of Hart Switches.**

GANG PLATES FOR ANY NUMBER.

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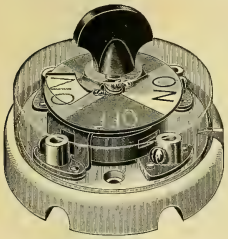


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QUALITY UNEQUALED.

FACTORY PRODUCTION TRIPLED.

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Wirt, Chas.

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Western Electric Co.

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Western Electric Co.

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Wertheim, Ed.
Western Electric Co.

**Compound.**
Standard Paint Co.

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Richards & Meacham.

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Bowers Bros.

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Fiberite Co., The.
Mason, J. W.
Nuttall Co. R. D.

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Eddy Elec. Mfg. Co.
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Electric Eng. & Supply Co.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
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General Elec. Co.
Hart & Hegeman Mfg. Co.
Imperial Porcelain Works.
Mason, J. W.
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Morrison Southern El. Co.
Nuttall Co., R. D.
Perkins Elec Switch Mfg Co.
Shawmut Fuse Wire Co.
Utica El. Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

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Brush Electric Co.
Card Electric Co.
Colburn Elec. Mfg. Co.
Dallett & Co., Thos. H.
Eddy Elec. Mfg. Co.
Electrical Eng. Co.
Ft. Wayne Elec. Corporation.
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McEwen, J. H. Mfg. Co.
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Bain, Poree.
Bryan & Humphrey.
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Schots, W. H.

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Nuttall Co., R. D.
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Rau Mfg. Co.

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Coburn Mfg. Co.
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Otto Gas Engine Wks.
Van Duzen Gaso. Eng. Co.
Weber Gas & Gaso'l Eng. Co.

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Hall Engine Co.
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Racine Hardware Co.
Toomey, Frank.
Weston Engine Co.

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Chic. Electro & Stereo Co.

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Edison Mfg. Co.
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Roth Bros. & Co.
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Hartaver Fibre Co.
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Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Shawmut Fuse Wire Co.

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Peerless Rubber Mfg. Co.

**Gears.**
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Nuttall Co., R. D.

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Besly & Co., Chas. H.
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Cutter El. & Mfg. Co.
Dickinson Elec. Supply Co.
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Electrical Eng. Co.
Electric Eng. & Supply Co.
Farr Tel. & Const. Supply Co.
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General Electric Co.
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Morrison Southern El. Co.
Northwest Engineering Co.
Pearson, F. J. Mfg. Co.
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Sioux City Brass Works.
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Utica El. Mfg. & Sup. Co.
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Fiberite Co., The.

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Chicago Fiberite Co.
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Electric Eng. & Supply Co.
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Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
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Hart & Hegeman Mfg. Co.
Hine & Co., L. A.
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Kartaverv Mfg. Co.
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Nuttall Co., R. D.
Okonite Co., The.
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Standard Underground C. Co.
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Chicago Ins. Wire Co.
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Eastern Electric Cable Co.
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Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
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Columbia Inc. Lamp Co.
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Electrical Eng. Co.
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Card Electric Co.
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Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Mayo, V. J.
Menominee El. & Mech. Co.
Northern Electl. Mfg. Co.
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Westinghouse El. & Mfg. Co.
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Ohio Storage Battery Co.
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Moore, Alfred F.
New York Insulated Wire Co.
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Simplex Electrical Co.
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Electrical Eng. Co.
Farr Tel. & Const. Supply Co.
Keystone Telephone Co.
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Smith, S. Morgan.
Stilwell, Heine & Smith Vale Co

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Tri. Corr. Dept.
Rose Polytechnic Institute.

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Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.

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Besly & Co., Chas. H.
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Brixey, W. R.
Electric Appliance Co.
Independent Electric Co
National India Rubber Co.
Nuttall, R. D.
Okonite Co., The
Phillips Insulated Wire Co.
Standard Underground C. Co.

**X Ray Outfits.**
LeRoy, J. A.


For Alphabetical Index of Advertisements See Page III.

# In Preparing This New Catalogue

We have been mindful of the needs of all our customers, and our sole aim has been to publish that which would prove helpful and serviceable to all who purchase electrical material of any kind. Our friends kindly say that we have not only achieved this purpose, but describe it as the "largest, handsomest and most complete electrical supply catalogue ever issued," "an encyclopedia of all other catalogues," "a reference book of everything electrical."

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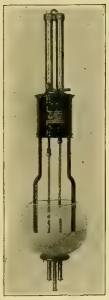
# ARC LAMPS.

Double Carbon Ornamental Arc Lamp.

Points of Superiority over Single Large Carbon Arc Lamps:

**30 Per Cent. Economy in Operation,**
**Greater Volume of Light,**
**No Energy Wasted in Heating Large Carbons,**
**Most Rapidly Trimmed, Lighter in Weight.**



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**ARE OPERATING AS SATISFACTORILY AS WHEN FIRST INSTALLED.**

**This is no Ninety Day Test!**

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**OF ALL KINDS.**

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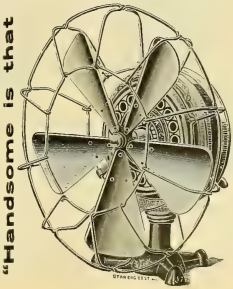
**ST. LOUIS, MO.,**

**And 112 Liberty St., New York.**

"Handsome is that Handsome does."



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**Current Consumption:**

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" 16-inch fan, 70 watts.
Induction 12-inch fan, 7,200 alts., 80 to 90 watts.
Induction 16-inch fan, 7,200 alts., 110 to 125 watts.
Induction 12-inch fan, 16,000 alts. 90 to 100 watts.

**CHEAPEST**

Fan Motors on the market because

**BEST.**

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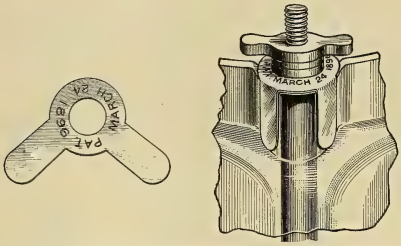


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**It keeps the zinc rod in the spout of the jar, where it belongs, and prevents it from wobbling around and leaning against the porous cup.**

**It is the most useful and the handiest little trick ever gotten up for a battery. All you have to do is to put the rod through the hole and bend the arms down close against the sides of the spout. Every jar should have one. Only costs a penny. Saves you from ten to fifty times that much.**

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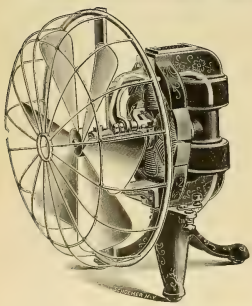

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**Factory: Orange, N. J.**

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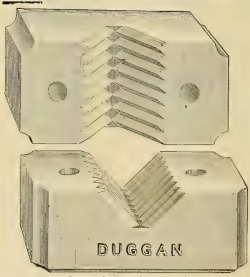
### LEADS THEM ALL.

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Made in one wire No. 4, 5 and 6.
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**They are corrugated and V-shaped groove.**
**They grip like a vise.**
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**They are made of the finest glazed porcelain. Ten of them used to one of any other make.**

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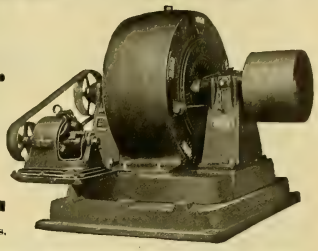

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Efficiency the Highest, Regulation the Closest, of any Alternating Current Generator Known.
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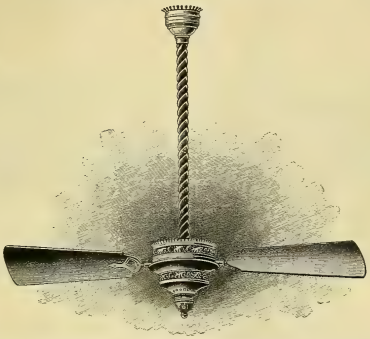

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Which gives the necessary amount of light without the objectionable glare of arc lamps. One of the

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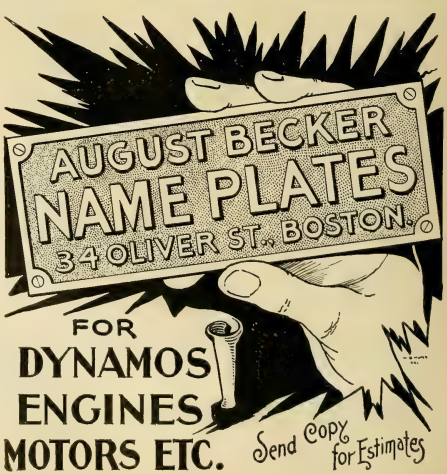

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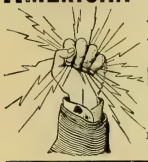

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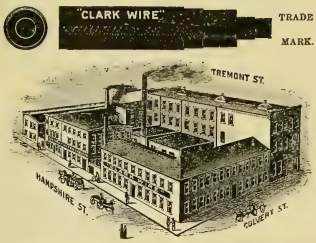


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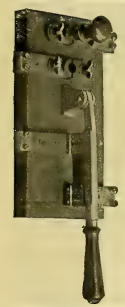

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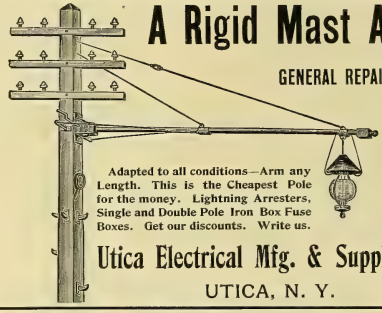

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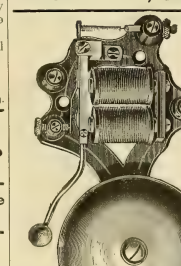

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CHAIRMAN BOARD OF CONTROL.

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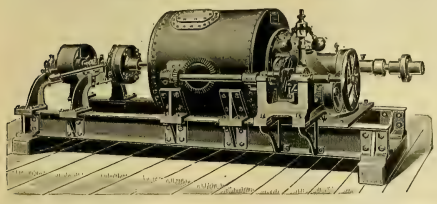

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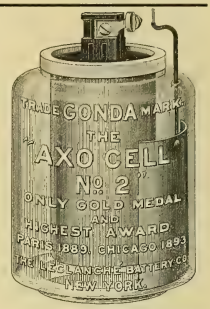


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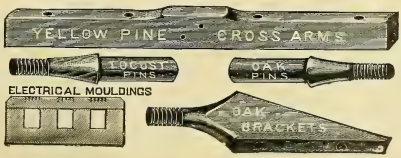

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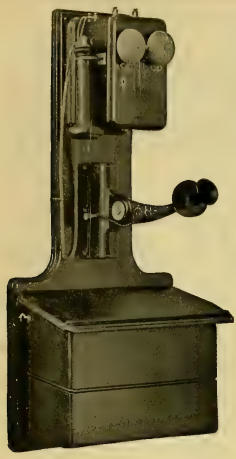

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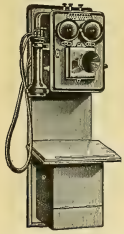

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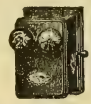

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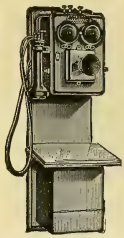

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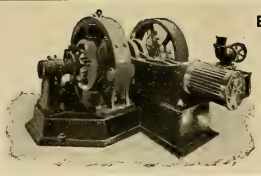

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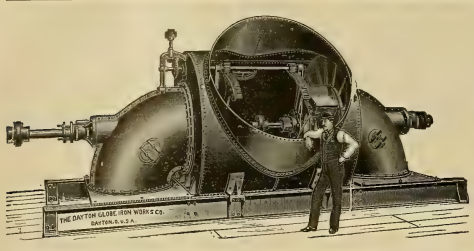


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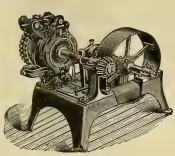

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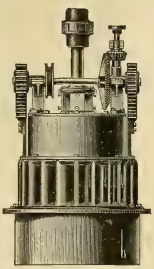

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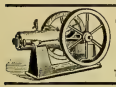

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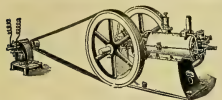

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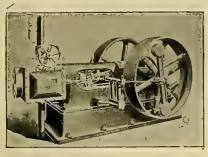

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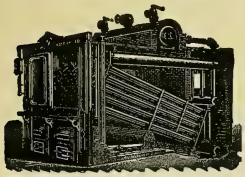

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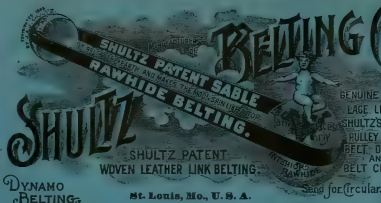
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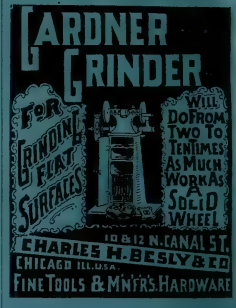
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Vol. XVIII. CHICAGO, JUNE 27, 1896. No. 26



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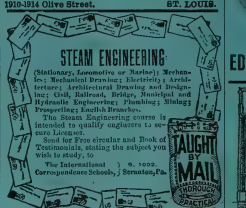

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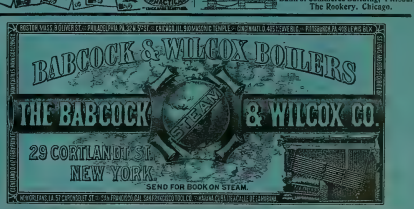


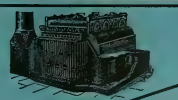

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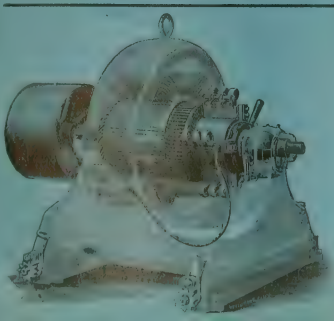

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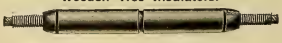

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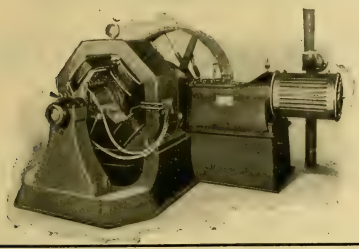

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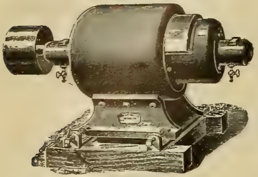

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Menominee El. & Mech. Co.

**Arc Lamps.**
Adams-Bagnall Elec. Co.
Chicago Gen'l Fixture Co.
Electric Arc Light Co.
Fleming-Spence Elec. Co.
Ft. Wayn Elec. Corporation.
Manhattan Gen'l Cons. Co.
Perkins Elec. Switch Mfg. Co.
Van Nuis, C. S.
Westinghouse El. & Mfg. Co.

**Arc Light Cord.**
Samson Cordage Wks.

**Assayers.**
Nat'l. Ore & Reduction Co.

**Batteries and Jars.**
Butler Hard Rubber Co.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Electric Storage Battery Co.
Gordon-Burnham Bat. Co.
Leclanche Battery Co., The.
Mason, J. W.
Menominee El. & Mech. Co.
Northwest Engineering Co.
Ohio Storage Battery Co.
Pearson, F. J. Mfg. Co.
Western Electric Co.

**Bells.**
Electric Appliance Co.
Huebel & Manger.
Menominee El. & Mech. Co.
Western Electric Co.

**Belting.**
Channon Co., H.
Chicago Belting Co.
Jewell Belting Co.
Rhoads & Sons, J. E.
Shultz Belting Co.

**Bicycles.**
Adams & Westlake Co.
Pope Mfg. Co.

**Boilers.**
Abendroth & Root Mfg. Co
American Boiler Co.
Babcock & Wilcox Co., The.
Clonbrock Steam Boiler Co.
Collins & Co., H. E.
Freeman & Sons Mfg. Co.
Moyes, L. M.
Racine Hardware Co.
Weston Engine Co.

**Books, Electrical.**
Electrician Publishing Co.

**Bronze.**
Besly & Co., Chas. H
Phosphor BronzeSm.Co.,Ltd.

**Brushes.**
Holmes Fibre-Graphite Co.
Mason, J. W.
Partridge Carbon Co
Solar Carbon & Mfg. Co
Wirt, Chas.

**Burglar Alarms.**
Electric Appliance Co.
Huebel & Manger
Menominee El. & Mech. Co
Western Electric Co

**Cables** (See Insulated Wires.)
**Cables, Electric** (See Insulated Wires), **Copper, Sheet and Bar.**
American Elec. Works.
Brixey, W. R
Eastern Electric Cable Co.
Moore, Alfred F.
New York Ins. Wire Co.
Simplex Electrical Co.
Standard Underground C. Co
Western Electric Co.

**Carbons, Points & Plates.**
American Carbon Co.
Chicago Edison Co
Chicago General Fixture Co
General Electric Co
Mason, J. W
Partridge Carbon Co.
Reisinger, Hugo.
Solar Carbon & Mfg. Co.
Standard Paint Co.
Wertheim, Ed.
Western Electric Co.

**Compound.**
Standard Paint Co.

**Construction & Repairs.**
Ft. Wayne Elec. Corporation.
Richards & Meacham.

**Contractors and Electric Light Plants.**
Akron Elec. Mfg. Co.
Arnold, B. J.
Bain, Foree.
Brush Electric Co.
Bryan & Humphrey.
Card Electric Co.
Eddy Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Northern Electl. Mfg. Co.
Schott, W. H.
Siemens & Halske Elec. Co.
United Elec ImprovementCo.
Warren Elec. Co
Westinghouse Elec & Mfg Co.
Western Electric Co.

**Copper.**
Besly & Co., Chas H.
Bowers Bros.

**Copper Wires.**
American Electrical Works.
Besly & Co., Chas H.
Brixey, W. R.
Chicago Edison Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Fiberite Co., The.
General Electric Co.
Independent Electric Co.
Mason, J. W.
Menominee El. & Mech. Co.
National India Rubber Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Western Electric Co.

**Cordage.**
Samson Cordage Wks.

**Crookes' Tubes.**
LeRoy, J. A.
Perkins Elec. Switch Mfg.Co.

**Cross-Arms, Pins and Brackets.**
Anderson, Albert & J. M.
Brady, T. H.
Central Mfg. Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Farr Tel & Const. Supply Co.
Fiberite Co., The.
Mason, J. W.
Nuttall Co. R. D.

**Cut-Outs and Switches.**
Anderson, Albert & J. M.
Ball-Ball Co., Ltd.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Eddy Elec. Mfg. Co.
Electric Appliance Co.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Forest City Elec. Wks.
Ft. Wayne Elec. Corporation.
General Elec. Co.
Hart & Hegeman Mfg. Co.
Imperial Porcelain Works.
Mason, J. W.
Menominee El. & Mech. Co.
Morrison Southern El. Co.
Nuttall Co., R. D.
Perkins Elec. Switch Mfg. Co.
Shawmut Fuse Wire Co.
Utica El. Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

**Dynamos.**
Akron Elec. Mfg. Co.
Brush Electric Co.
Card Electric Co.
Colburn Elec. Mfg. Co.
Dallett & Co., Thos. H.
Eddy Elec. Mfg. Co.
Electrical Eng. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Hine & Co., L. A.
Mayo, V. J
McEwen, J. H. Mfg. Co.
Northern Electl. Mfg. Co.
Roth Bros. & Co.
Siemens & Halske Elec. Co.
Toomey, Frank.
Triumph Elec. Co.
Warren Electric Co.
Westinghouse El. & Mfg. Co.
Willard Storage Battery Co.

**Economizers, Fuel.**
Fuel Economizer Co.

**Electric Heaters.**
Johns, H. W., Mfg. Co.

**Electric Railways.**
Brush Electric Co.
Card Electric Co.
General Electric Co.
Siemens & Halske Elec. Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold, B. J.
Bain, Foree.
Bryan & Humphrey.
Eddy Elec. Mfg. Co.
Schott, W. H.

**Electrical Instruments.**
Anderson, Albert & J. M
Biddle, James G.
Chicago Edison Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Electric Appliance Co.
Nuttall Co., R. D.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Electrical Specialties.**
Brockton Elec. Mfg. Co.
Commercial Elec. Sup. Co.
Imperial Porcelain Works.
Menominee El. & Mech. Co.
Pearson, F. J. Mfg. Co.
Rau Mfg. Co.

**Electro-Plating Mach'y.**
Besly & Co., Chas. H.
Colburn El. Mfg. Co.
General Electric Co.

**Engines, Gas.**
Norman Co., J. J.
Otto Gas Engine Wks.
Van Duzen Gaso. Eng. Co.

**Engines, Steam**
Ball & Wood Co., The.
Ball Engine Co.
McEwen, J. H. Mfg. Co.
Racine Hardware Co.
Toomey, Frank.
Weston Engine Co.

**Exhaust Pipe Heads.**
Faucett, I. L.

**Fan Outfits.**
Diehl Mfg. Co.
Edison Mfg. Co.
Emerson Elec. Mfg. Co.
Hunter Fan & Motor Co.
Roth Bros. & Co.
Westinghouse El. & Mfg. Co.

**Feed Water Heaters.**
Goubert Mfg. Co.

**Fibre.**
Holmes Fibre-Graphite Co.
Kartavert Mfg. Co.
Vulcanized Fibre Co.

**Files.**
Barnett Co., G. & H.

**Fire Alarms.**
Western Electric Co

**Fuse Wire.**
Brixey, W. R
Electric Appliance Co.
Fiberite Co., The
General Electric Co
Independent Electric Co.
Shawmut Fuse Wire Co.

**Gaskets.**
Johns, H. W., Mfg. Co.
Peerless Rubber Mfg. Co.

**Gears.**
Besly & Co., Chas. H.
Nuttall Co., R. D.

**General Elec. Supplies.**
Anderson, Albert & J. M.
Andrae & Sons Co., J.
Ball-Ball Co., Ltd.
Besly & Co., Chas. H.
Chicago Edison Co.
Chicago Gen'l Fixture Co.
Commercial Elec. Sup. Co.
Cutter El. & Mfg. Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co.
Forest City Elec. Wks.
General Electric Co.
Huebel & Manger.
Johns, H. W., Mfg. Co.
Mason, J. W.
Menominee El. & Mech. Co.
Metropolitan Electric Co.
Morrison Southern El. Co.
Northwest Engineering Co.
Pearson, F. J. Mfg. Co.
Peru Elec. Mfg. Co.
Shawmut Fuse Wire Co.
Sioux City Brass Works.
Standard Tel. & Elec. Co.
Utica El Mfg. & Sup. Co.
Westinghouse El. & Mfg. Co.

**Globes and Electrical Glassware.**
Chicago Gen'l Fixture Co.
Phoenix Glass Co.

**Gov'nors. Water Wheel.**
LombardWaterWheelGv.Co.

**Graphite Specialties.**
Besly & Co., Chas. H.
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

**Hard Rubber Goods.**
Butler Hard Rubber Co.
Fiberite Co., The.

**Insulators and Insulating Materials.**
Anderson, Albert & J. M.
Brixey, W. R
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Electric Appliance Co.
Electric Eng. & Supply Co.
Empire China Works.
Eyanson & Armpriester.
Farr Tel. & Const. Supply Co.
Fiberite Co., The.
Hart & Hegeman Mfg. Co.
Hine & Co., L. A.
Johns Mfg. Co., H. W.
Kartavert Mfg. Co.
Mason, J. W.
Menominee El. & Mech. Co.
National India Rubber Co.
New York Insulated Wire Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Standard Paint Co.
Simplex Electrical Co.
Standard Underground C. Co.
Utica El. Mfg. & Sup. Co.

**Insulated Wires and Cables—Magnet Wires.**
American Electrical Works.
Brixey, W. R.
Chicago Edison Co.
Chicago Ins. Wire Co.
Commercial Elec. Sup. Co.
Eastern Electric Cable Co.
Electric Appliance Co.
Farr Tel. & Const. Supply Co.
General Electric Co.
Independent Electric Co.
Lasell & Co., Edward.
Mason, J. W.
Metropolitan Electric Co.
Moore, Alfred F.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.

**Lamps, Incandescent.**
Adams-Bagnall Elec. Co.
Buckeye Electric Co.
Chicago Edison Co.
Columbia Inc. Lamp Co.
Dickinson Elec. Supply Co.
Electric Appliance Co.
Ft. Wayne Elec. Corporation.
General Electric Co.,
Orient Electric Co.
Perkins Elec. Switch Mfg. Co.
Standard Incan. Lamp Co.
United Elec. Imp. Co.
Westinghouse El. & Mfg. Co.
Wormley, Jas. C. & Co.

**Lightning Arresters.**
Electric Appliance Co.
Garton-Daniels Electric Co.
General Electric Co.
Utica El. Mfg. & Sup. Co.
Van Nuis, C. S.
Westinghouse El. & Mfg. Co.

**Magnet Wire.**
(See Insulated Wires.)

**Mechanical Machinery.**
Besly & Co., Chas. H.
Bliss Co., E. W.
Ferracute Machine Co.

**Mica.**
Bowers Bros.
Electrical Eng. Co.
Johns Mfg. Co., H. W.
Munsell & Co., Eugene.
Schoonmaker, A. O.

**Mining Apparatus, Elec.**
General Electric Co.
Independent Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.**
Akron Elec. Mfg. Co.
Brush Electric Co.
Card Electric Co.
Colburn El. Mfg. Co.
Dallett & Co., Thos. H.
Diehl Mfg. Co.
Eddy Elec. Mfg. Co.
Electrical Eng. Co.
Emerson Elec. Mfg. Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Mayo, V. J.
Menominee El. & Mech. Co.
Northern Electl. Mfg. Co.
Porter Motor Co.
Sioux City Brass Works.
Stanley Elec. Mfg. Co.
Storey Motor & Tool Co.
Westinghouse El. & Mfg. Co.
Willard Storage Battery Co.

**Name Plates.**
Becker, August.

**Oil Feeders.**
Dalley, Jas. W.

**Packing.**
Besly & Co. Chas. H.
Garlock Packing Co.
Johns, H. W., Mfg. Co.
Peerless Rubber Mfg. Co.

**Paints.**
Johns, H. W., Mfg. Co.
Standard Paint Co.

**Patent Agencies.**
Washington Patent Agency.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd.

**Platinum.**
Baker & Co.

**Poles.**
Brown, DeWitt, Cedar Co.
Central Mfg. Co.
Hart, C. S.
Lewis & Co., A. L.
Morris, Tasker & Co.
Nuttall Co., R. D.
Perrizo, Paul, Jr. Co.
Valentine-Clark Co.

**Porcelain.**
Commercial Elec. Sup. Co.
Empire China Works.
General Electric Co.
Imperial Porcelain Works.

**Publishers, Electrical.**
Electrician Publishing Co.

**Push Buttons.**
Electric Appliance Co.
Northwest Engineering Co.

**Rheostats.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Sal Ammoniac.**
Klipstein & Co., A.

**Speaking Tubes.**
Electric Appliance Co.

**Speed Indicators.**
Besly & Co., Chas. H.
Biddle, James G.
Weston Electrical Inst. Co.
Whitney Elec. Inst. Co.

**Springs.**
Barnes, Wallace.

**Steam Heating.**
Goubert Mfg. Co.
Webster & Co., Warren.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Ohio Storage Battery Co.
Willard Storage Battery Co.

**Street Cars.**
Brill, J. G. Co
Ladd, A. W.

**Tapes, Insulating.**
American Electrical Works.
Brixey, W. R.
Chicago Ins. Wire Co
Electric Appliance Co.
Moore, Alfred F.
New York Insulated Wire Co.
Okonite Co., The.
Simplex Electrical Co.
Standard Paint Co.

**Telegraph Apparatus.**
Electric Appliance Co.
Western Electric Co.

**Telephones and Telephone Material.**
Andrae & Sons Co., J.
Commercial Elec. Sup. Co.
Conn. Tel. & El. Co.
Electrical Eng. Co.
Farr Tel. & Const. Supply Co.
Keystone Telephone Co.
Mason, J. W.
Northwest Engineering Co.
Richards & Meacham.
Standard Tel. & Elec. Co.
Viaduct Mfg. Co.
Western Elec. Co.
Williams & Abbott El. Co.

**Transformers.**
Chicago Gen'l Fixture Co.
Ft. Wayne Elec. Corporation.
General Electric Co.
Stanley Electric Mfg. Co.
Westinghouse El. & Mfg. Co.

**Trolley Cord.**
Samson Cordage Wks.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbine Wheels.**
Dayton Globe Iron Works Co.
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.
Stilwell-Bierce & Smith Vaile Co

**Universities.**
Cor. School of Technology.
Int. Corr. Schools.
Rose Polytechnic Institute.

**Water Wheels.**
Dayton Globe Iron Works Co
Leffel & Co., Jas.
Replogle Governor Wks.
Smith, S. Morgan.

**Wire, Bare.**
Anderson, Albert & J. M.
Besly & Co., Chas H.
Bi-Metallic El. Trans. Co.
Brixey, W. R.
Electric Appliance Co.
Independent Electric Co.
National India Rubber Co.
Nuttall Co., R. D.
Okonite Co., The.
Phillips Insulated Wire Co.
Standard Underground C. Co.

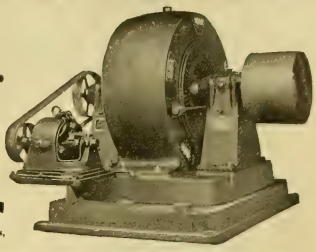
**X Ray Outfits.**
LeRoy, J. A.

For Alphabetical Index of Advertisements See Page III.

# The Warren Alternator.

**INDUCTION TYPE** | Without Moving Wires. Without Collector Rings. Without Brushes.

## Any Voltage 110 220 440 Volts without 1,000 2,000 6,000 Volts with Transformers.



STATIONARY SINGLE RING ARMATURE—STATIONARY FIELD COIL.
Revolvable Part a Solid Cylinder of Steel.
Efficiency the Highest, Regulation the Closest, of any Alternating Current Generator Known.
Noiseless in Operation. Built to Earn Money With, not to Spend Money Upon.

## WARREN ELECTRIC CO., CHICAGO.

SALES AGENTS:
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A. M. Searles, 281 Dearborn St., Chicago.
California Electrical Works, San Francisco, Cal.

No. 1 Plate for 5 and 10 Amp. Hart Switches.

# HART FLUSH SWITCHES.

New Face Plate.

## BETTER PROPORTIONS. BETTER FINISH. MORE DURABLE.

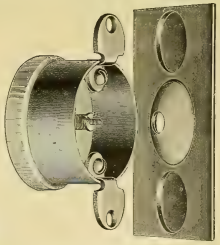
Made of solid plate brass ⅛ inch thick, with beveled edges.

Better Design,
Better Material,

Self-Adjusting Handle,
No Breaking,

No Binding on Face Plates,
No Loose Face Plates.
Handles, Switches and Face Plates Interchangeable.

Single Plates for all sizes of Hart Switches.
Gang Plates for any number of Hart Switches.



Back of No. 1 Plate.

**SEND FOR "CATALOGUE B."**

## THE HART & HEGEMAN MFG. CO., HARTFORD, CONN.

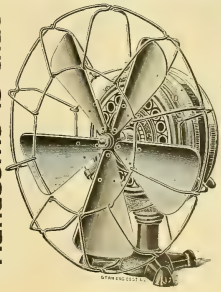
# ARC LAMPS

OF ALL KINDS.
PLAIN, ORNAMENTAL,
For Direct and Alternating Current.
Write for Catalogue.

## The Adams & Westlake Co.,
110 Ontario St., CHICAGO.

## THE EMERSON ELECTRIC MFG. CO.,
ST. LOUIS, MO.,
And 112 Liberty St., New York.

"Handsome is that Handsome does."



TYPE E. I. I.

NOTE THIS
Current Consumption:

"Meston" 12-inch fan, 60 to 70 watts.
" 16-inch fan, 70 watts.
Induction 12-inch fan, 7,200 alts., 80 to 90 watts.
Induction 16-inch fan, 7,200 alts., 110 to 125 watts.
Induction 12-inch fan, 16,000 alts. ,90 to 100 watts.

CHEAPEST
Fan Motors on the market because
BEST.

THE
# UNITED ELECTRIC IMPROVEMENT CO.

OFFICE AND WORKS:
*19th St. and Allegheny Ave., PHILADELPHIA, PA.*

New Discounts on Standard Series Incandescent Lamps For all Systems and for any Current, Candle-Power or Base.

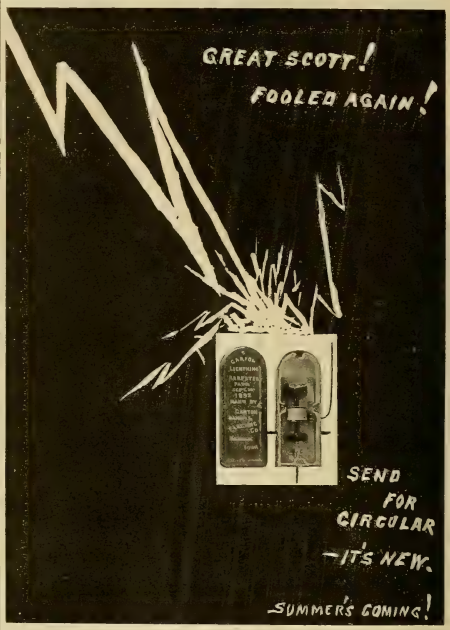
*TRIAL ORDER SOLICITED.*

**Alternating Current Generators, Transformers, Motors. Arc Lamps and Switchboard Equipment for Central Stations.**

*WRITE FOR DESCRIPTIVE CATALOGUE.*

**Multipolar and Bipolar Direct Current Dynamos and Appurtenances for Isolated Plants.**
**Improved Long Distance Series Incandescent Apparatus and Supplies.**

CORRESPONDENCE SOLICITED. SATISFACTION GUARANTEED.




# THE S. K. C. SYSTEM.

**A COMPLETE SYSTEM FOR**

## Long Distance Transmission, General Station Distribution, Mill and Factory Equipment.

Generators will be wound and guaranteed for an E. M. F. as high as

**10,000 VOLTS.**

CORRESPONDENCE SOLICITED

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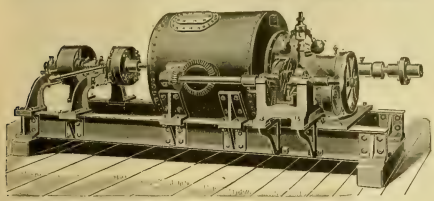
**Pittsfield, Mass., U. S. A.**

THE ROYAL ELECTRIC CO., Montreal, Canada, are sole licensees for the manufacture and sale of the S. K. C. System in Canada. . . . . .

**BRANCHES OFFICES:**
Chicago, 305 Dearborn St.
Boston, Equitable Building.
New York, 39 Cortlandt St.
San Francisco, 106 Market St.
Anderson, S. C.

# Victor Turbine Water Wheel.



**Cylinder or Register Gate—Close Regulation and High Efficiency at Full and Partial Gate.**

The attention of ELECTRIC COMPANIES is called to this **CELEBRATED WATER WHEEL** as particularly adapted to their use, on account of its **remarkably steady motion, high speed and great efficiency and large capacity** for its **diameter,** being **double the power** of most wheels of the same diameter. It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent of useful effect **guaranteed.**

*SEND FOR CATALOGUE AND PARTICULARS.*

The accompanying engraving represents a single 10-inch Victor Turbine on horizontal shaft to develop 36 H. P. under 38 feet head. Arranged with 12-inch Worrell Friction Coupling at one end to disconnect pulley.

We are now prepared to furnish Victor Turbines, either single or in pairs, on horizontal shafts, and where the situation admits of their use we recommend them.

**THE STILWELL-BIERCE & SMITH-VAILE CO., DAYTON, OHIO.**

Risdon Iron & Locomotive Works, San Francisco, Cal., Pacific Coast Agents.

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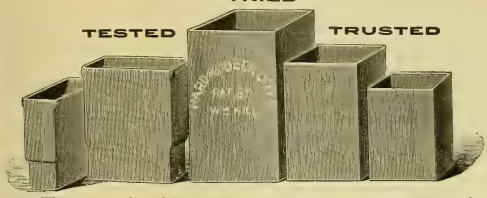
## Most Durable Battery Cells Produced.

TRIED

TESTED TRUSTED



ROD SHEET, TUBING. Flexible Hard Rubber Tubing. INSULATOR HOOKS.

Telephone Receivers, Battery Syringes, Bushings, Etc.

Manufactured by **The Butler Hard Rubber Co. 33 Mercer St., N. Y.**

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# LE ROY'S IMPROVED ALUMINUM X-RAY FLUOROSCOPE.

**FOUR TIMES AS SENSITIVE AS ANY YET MADE.**

Low Price, High Quality. | Complete Portable X-Ray Outfits for Physicians | Goods Guaranteed. Weight 6 Ounces.

**AND OTHERS DESIRING AN OUTFIT FOR EXPERIMENTAL USE.**

Send stamp for circular.

**J. A. LE ROY. 143 E. 13th St., New York.**

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## IRON ARMORED CONDUIT

(CUMMING'S PATENTS)

**FOR INTERIOR CONSTRUCTION.**

ARMORITE - INTERIOR - CONDUIT - COMPANY,

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MANUFACTURERS OF

## Fan Motors,

Annunciators, Medical Batteries, Induction and Spark Coils, Magneto Generators, Knife Switches, Binding Posts, Etc., Etc.

*WRITE FOR PRICES.*

Menominee Elec. & Mch. Co.,

MENOMINEE, MICH.

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The Electrician Publishing Co., Suite 510 Marquette Bldg., Chicago. Headquarters for all latest Electrical Books. Write for Catalogue.

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WORCESTER POLYTECHNIC INSTITUTE,

**WORCESTER, MASS.**

FIVE COURSES OF STUDY.

Mechanical, Civil and Electrical Engineering. Chemistry, General Scientific Course. **158-page Catalogue,** showing appointments secured by graduates, *mailed free. Expenses low. 29th year.*

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**T. H. Brady, New Britain, Conn., U. S. A.,**

Manufacturer of Mast Arms, Pole and Swinging Hoods, Horse Brackets and other Specialties for Construction Work.—*Catalogues and Prices furnished on application.*

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Are made only by

Charles Wirt, 1026 Filbert, Philadelphia.

For Sale by the Trade.

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WALLACE BARNES,

*Manufacturers of*

FLAT, COILED AND WIRE

## STEEL SPRINGS

OF EVERY DESCRIPTION.

Send sample for prices. **Bristol, Conn.**

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**Western Electrician**

**$1.00 EACH.**

ELECTRICIAN PUB. CO.,

CHICAGO.

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The Standard Open Circuit Batteries of the World.

SEND FOR CIRCULAR AND PRICES.

**THE LECLANCHE BATTERY CO.,**

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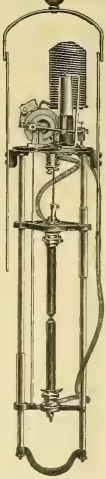

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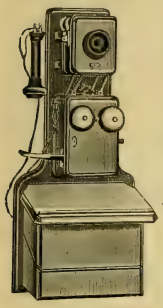

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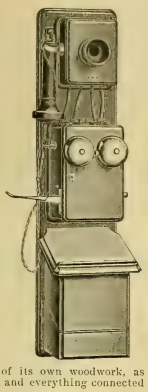

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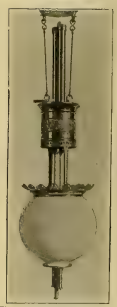

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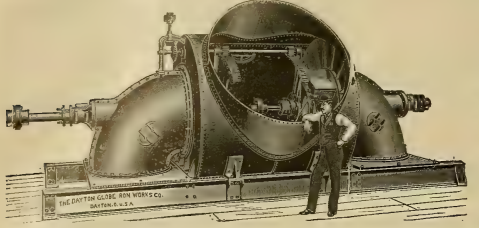

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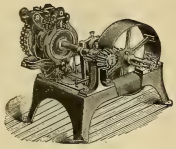

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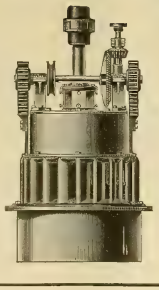

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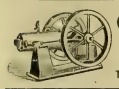

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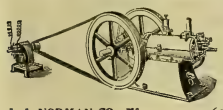

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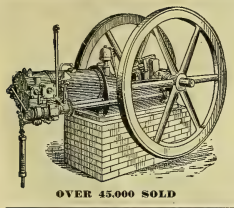

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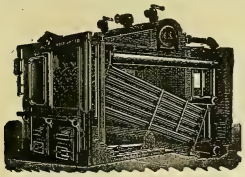

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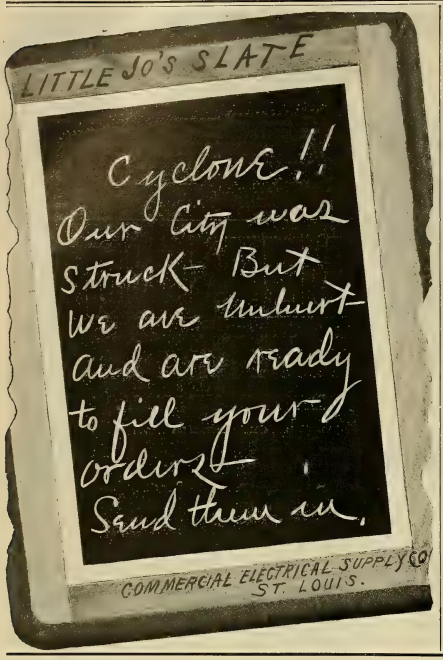

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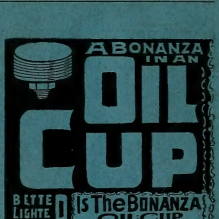


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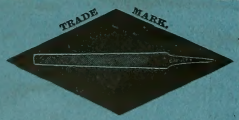


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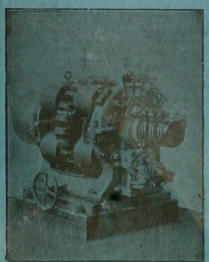
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